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UNCLASSIFIED

Y-817

Subject Category: CHEMISTRY

UNITED STATES ATOMIC ENERGY COMMISSION

PRODUCTION OF ZIRCONIUM AT Y-12

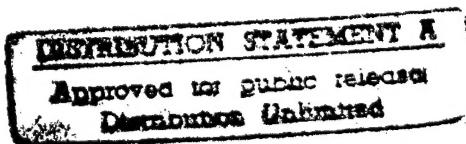
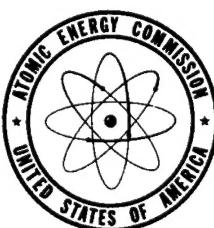
By
J. W. Ramsey
W. K. Whitson, Jr.

DTIC QUALITY INSPECTED 2

October 12, 1951

Carbide and Carbon Chemicals Company
Oak Ridge, Tennessee

Technical Information Service, Oak Ridge, Tennessee



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Y-817

CARBIDE AND CARBON CHEMICALS COMPANY
A DIVISION OF UNION CARBIDE AND CARBON CORPORATION

Y-12 PLANT

W-7405-Eng-26

CHEMICAL DIVISION

Mr. J. M. Herndon, Superintendent

CHEMICAL DEPARTMENT

Mr. G. A. Strasser, Superintendent

PRODUCTION OF ZIRCONIUM AT Y-12

J. W. Ramsey
W. K. Whitson, Jr.

ABSTRACT

A general description is given of the permanent zirconium plant at Y-12. Equipment is described and materials of construction are listed. Photographs illustrating principal equipment and reduced construction drawings are also presented. Operating conditions and costs information are listed.

Oak Ridge, Tennessee

October 12, 1951

INTRODUCTION

Production of purified hafnium-free zirconium was begun at Y-12 in January, 1950. At the request of the Atomic Energy Commission, a quick installation of equipment was made in order to produce 25,000 pounds of zirconium as oxide for initial experiments for the Naval Reactor Program. Less than 0.1% contained hafnium was specified. At that time, a program was started on designing a more efficient plant for the production of 150,000-200,000 pounds of zirconium per year. The permanent zirconium plant was completed in October, 1951. Additions were made to the extraction facilities and equipment for continuous purification by the phthalate process and continuous drying and calcining were provided.

At the time of this writing, the permanent zirconium plant is in the start-up stage. This report describes the equipment and process as they now exist and the operational plans which have been developed from experience and from laboratory and pilot plant work.

The original proposal for the permanent zirconium plant is outlined in a report, Y-573, "Separation of Zirconium and Hafnium - Proposal for Construction and Operation of Zirconium Production Plant", J. M. Googin and G. A. Strasser, March 14, 1950. These plans have been followed to completion with but few changes. Greater length of extraction and stripping columns was installed than was first planned in order to effect more complete separation

which was later requested. Later information obtained on calcining showed that protection against contamination in this stage was more difficult than had been expected, and consequently the expense of more elaborate calcination equipment was required. Corrosion of exteriors from vapors in the processing areas was found to be a serious problem and more elaborate ventilation and protective measures were taken than had been planned in the proposal. Otherwise the original proposal has been followed through approximately as first outlined.

It is suggested that reference should be made to report Y-573 relative to studying the report presented here.

DESCRIPTION OF PROCESS

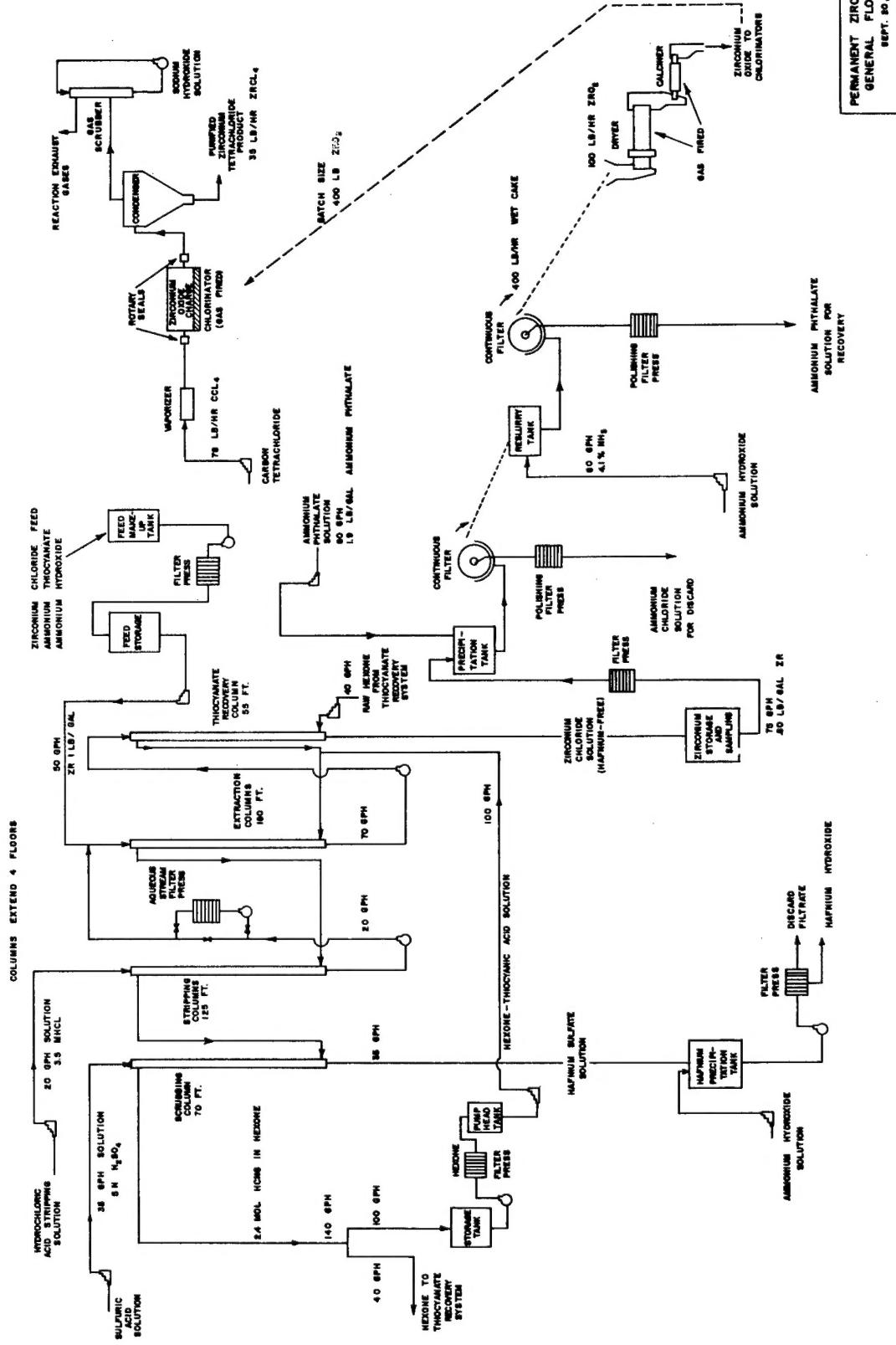
The attached flow sheet and photographs illustrate the permanent zirconium plant in Building 9211 at Y-12.

Zirconium tetrachloride, normally containing from 1.5 percent to 2.0 percent hafnium, is received from Titanium Alloy Manufacturing Division of the National Lead Company for use as feed material. Hafnium is removed from zirconium by an extraction process and resulting solutions are further purified by phthalate precipitation. Zirconium phthalate is converted to zirconium hydroxide by ammonium hydroxide leaching and the zirconium hydroxide is dried and calcined. The zirconium oxide is then chlorinated to form zirconium tetrachloride, which is used in magnesium reduction to the metal.

The steps in processing at Carbide and Carbon Chemicals Company, Y-12 Plant, are shown on the attached flow sheet and outlined as follows:

Hafnium Separation

Hafnium is separated from zirconium by a solvent extraction process employing methyl iso-butyl ketone. The separation is carried out in continuous counter-current spray towers. Solution containing normal zirconium is fed in the center of the extraction plant. The zirconium solution flows out the bottom of the plant while the hafnium is carried by the solvent to the top of the plant.



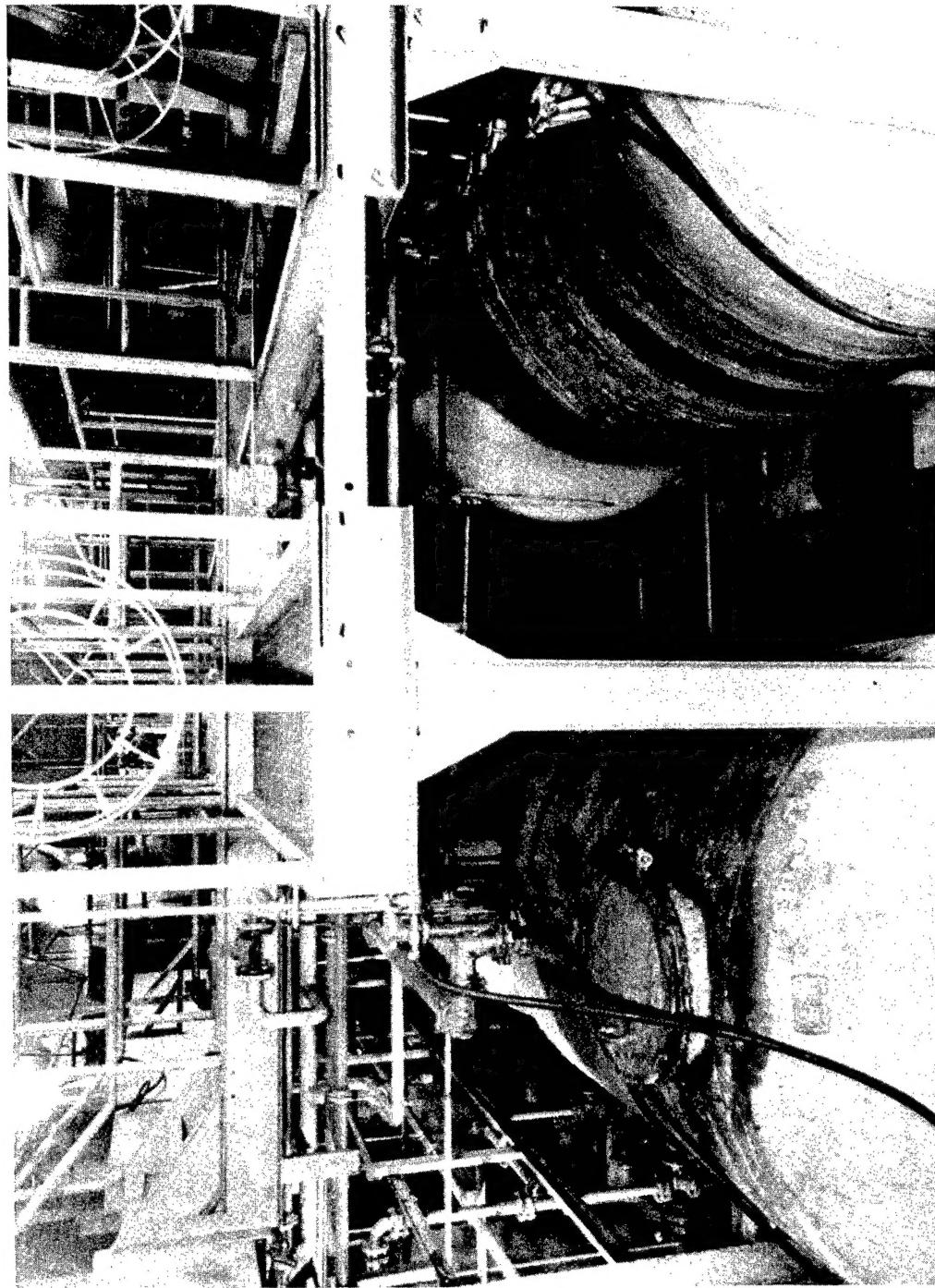
**PERMANENT ZIRCONIUM PLANT
GENERAL FLOW DIAGRAM**

Zirconium tetrachloride is dissolved in water (top center of flow sheet) and the required quantities of ammonium thiocyanate and ammonium hydroxide are added to form the extraction feed solution. Some of the equipment used is shown in Figure 1, "Feed Make-up and Storage Area - Tank Pit". Feed solution is pumped to the column (Figure 2, "Base of Extraction Columns-First Floor"). There are three columns for extraction, two columns for stripping, one column for scrubbing, and one column for thiocyanate recovery. Columns are controlled by operators on the third floor (Figure 3, "Extraction Control Area").

Hafnium thiocyanate is preferentially extracted into hexone-thiocyanic acid solution, which is pumped into the bottom of the extraction column. Hexone from the extraction column flows into the stripping column, counter-current to a stripping solution of dilute hydrochloric acid. Aqueous stripper solution containing stripped zirconium is fed back into the extraction column with the extraction feed solution. Stripped hexone containing very pure hafnium flows into the scrubbing column where it is scrubbed with sulfuric acid solution. This hexone, free of metal, but still containing thiocyanic acid is recirculated to the extraction columns.

For smallest usage of thiocyanate, it is desirable to have thiocyanate concentration in the product stream at a very low level. This is accomplished

FIGURE I. FEED MAKEUP AND STORAGE AREA - TANK PIT



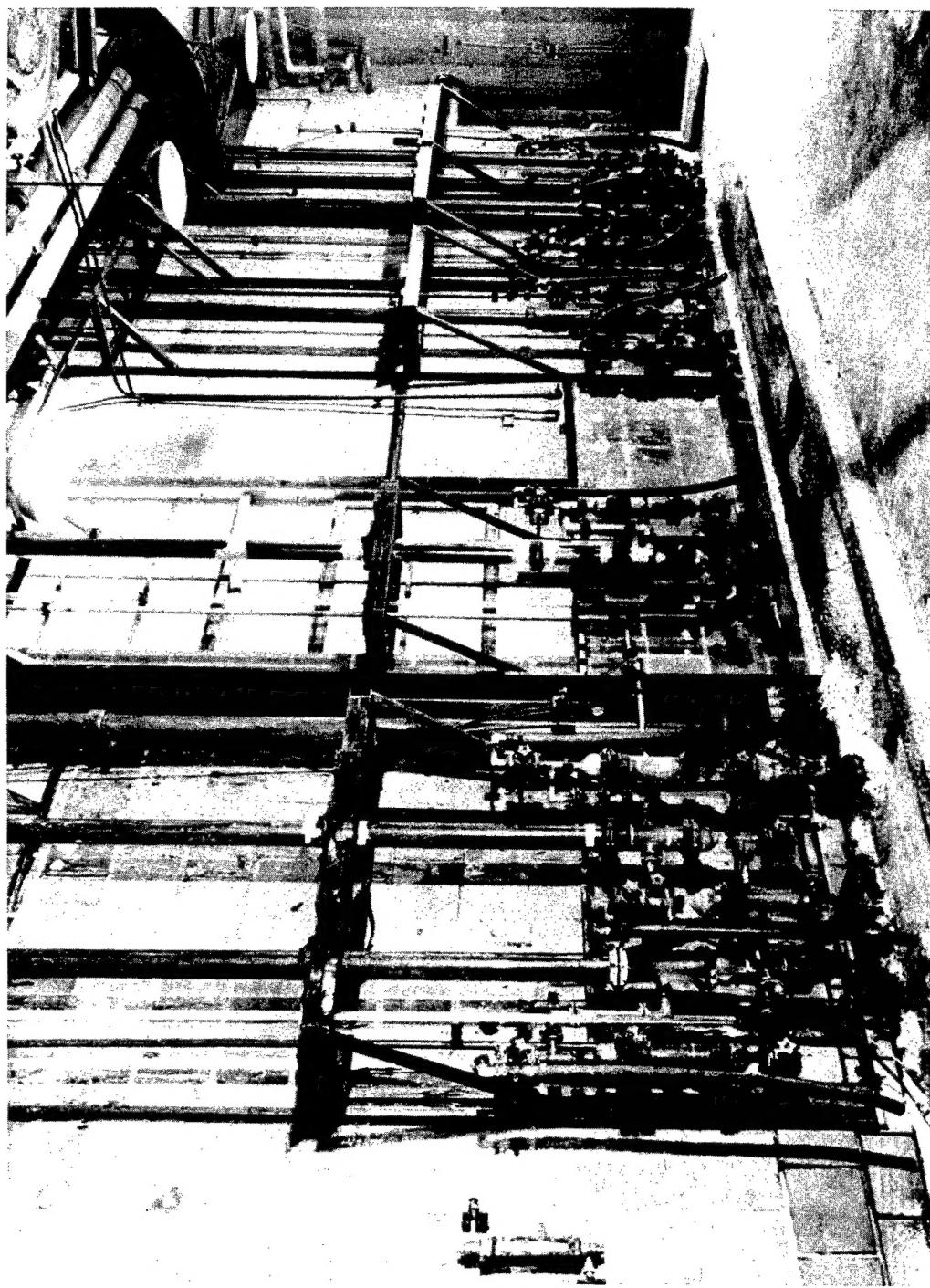


FIGURE 2. BASE OF EXTRACTION COLUMNS- FIRST FLOOR

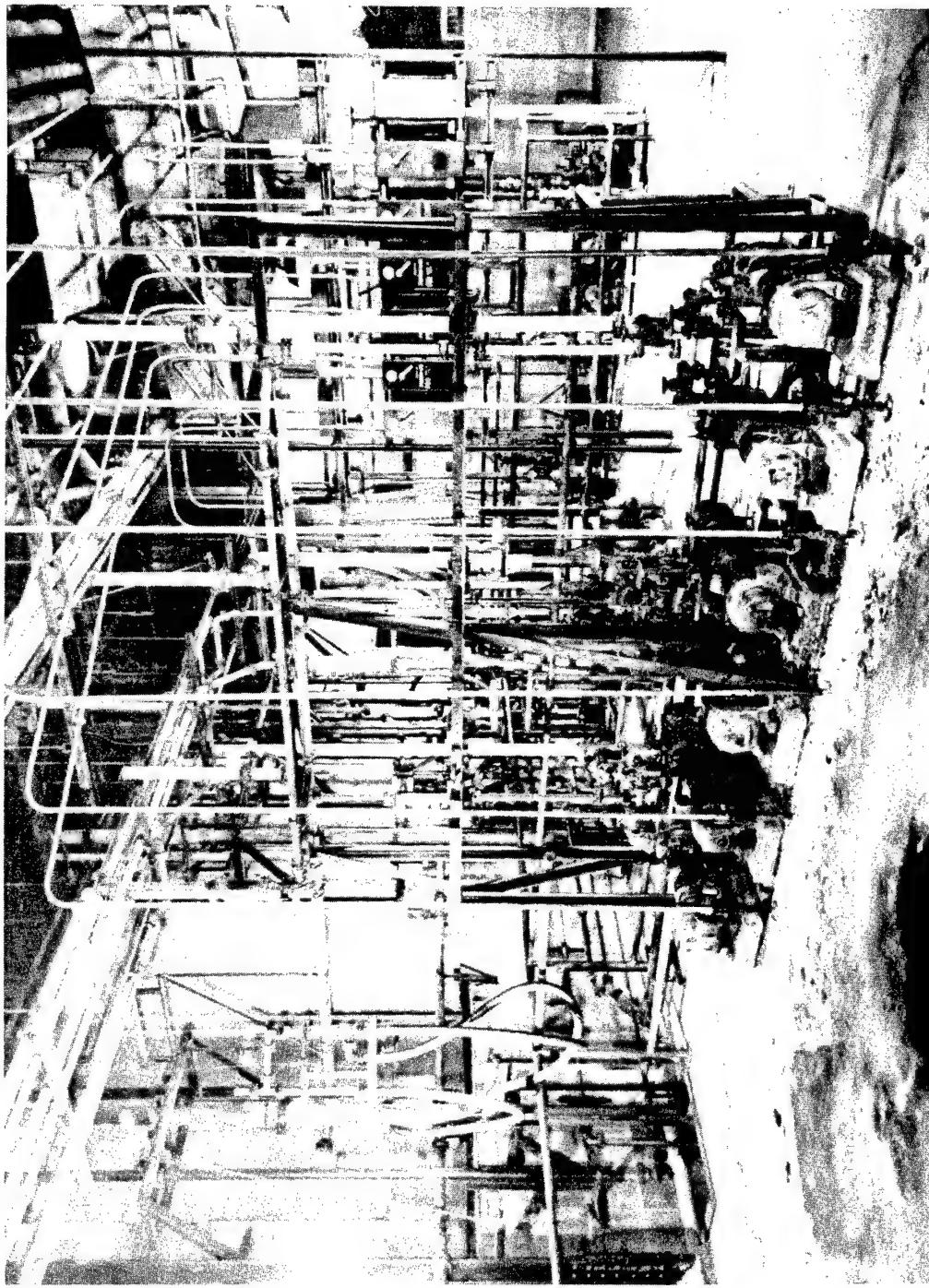


FIGURE 3. EXTRACTION CONTROL AREA - THIRD FLOOR

by directing the aqueous solution from the third extraction column into a thiocyanate recovery column. The thiocyanate recovery column is fed with raw hexone at a rate of approximately one-third the total hexone flow. Hexone from this column contains thiocyanic acid at the proper concentration for extraction and is mixed with the hexone entering the extraction columns. Raw hexone to be fed to the thiocyanate recovery column is prepared from a portion of the scrubbed hexone diverted to an ammonium neutralization system. Ammonium thiocyanate from this system is used in feed makeup.

Zirconyl chloride solution, hafnium-free, goes from the last extraction column to a tank for storage and sampling, and then to be further processed by precipitation with ammonium phthalate solution.

The hafnium is recovered from the hexone by sulfuric acid scrubbing. Hafnium is recovered from the sulfuric acid solution as hafnium hydroxide by precipitation with ammonium hydroxide.

Separation of Other Impurities

While hafnium is the element requiring special separation procedures, it is also necessary to remove other metal ions present as impurities in the feed material. This purification is carried out by precipitating zirconium as zirconyl phthalate. The phthalate precipitation is very selective for zir-

conium and hafnium, while other impurities, such as iron, copper, cadmium, etc., remain in solution and are thus separated.

In the permanent zirconium plant, ammonium phthalate solution and zirconium chloride solution are fed continuously to a precipitation tank, which, in turn, feeds a continuous Eimco filter. This equipment is shown in Figure 4, "Phthalate Precipitation Equipment and Filters." Cake is scraped continuously from the filter and reslurried with ammonium hydroxide solution. This slurry is filtered on a continuous Oliver filter. The ammonium phthalate solution from the filter is recovered by evaporation. (Figure 5, "Ammonium Phthalate Evaporator").

Zirconium hydroxide cake from the Oliver filter falls from the filter scraper blade through a chute into a continuous gas-fired drier, manufactured by the Bartlett-Snow Company. This is shown in Figure 6, "Assembly Work on Drier - Third Floor." The dried zirconium hydroxide falls continuously into silica-lined calciners in which it is converted to high purity zirconium oxide, (Figure 7, "Calciner - Second Floor"). Calciners were also manufactured by the Bartlett-Snow Company, and liners are supplied by the Amersil Company and the General Ceramics Company.

Hafnium hydroxide is redissolved and purified by the same chemical process

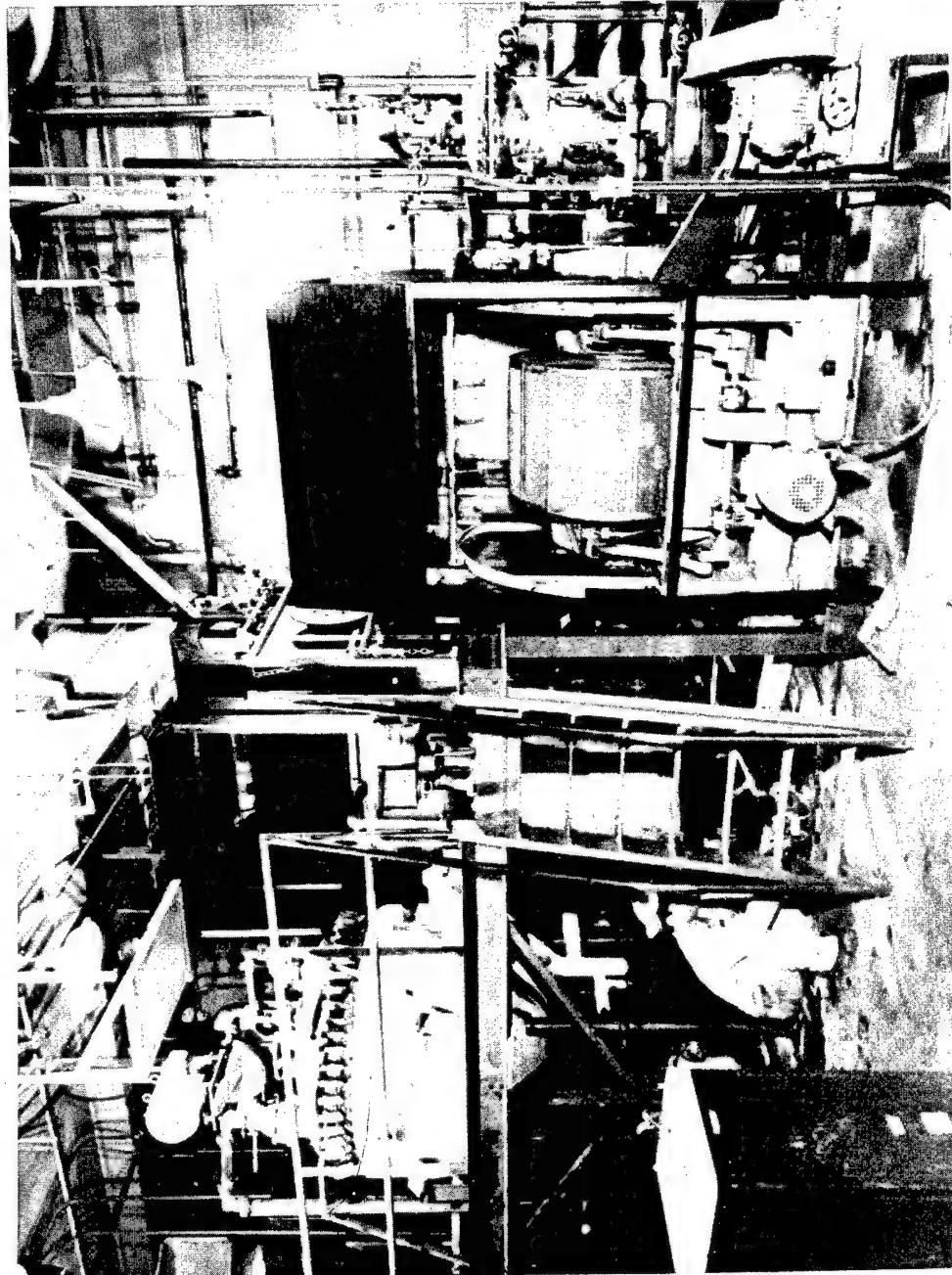


FIGURE 4. PHTHALATE PRECIPITATION EQUIPMENT AND FILTERS -
FOURTH FLOOR

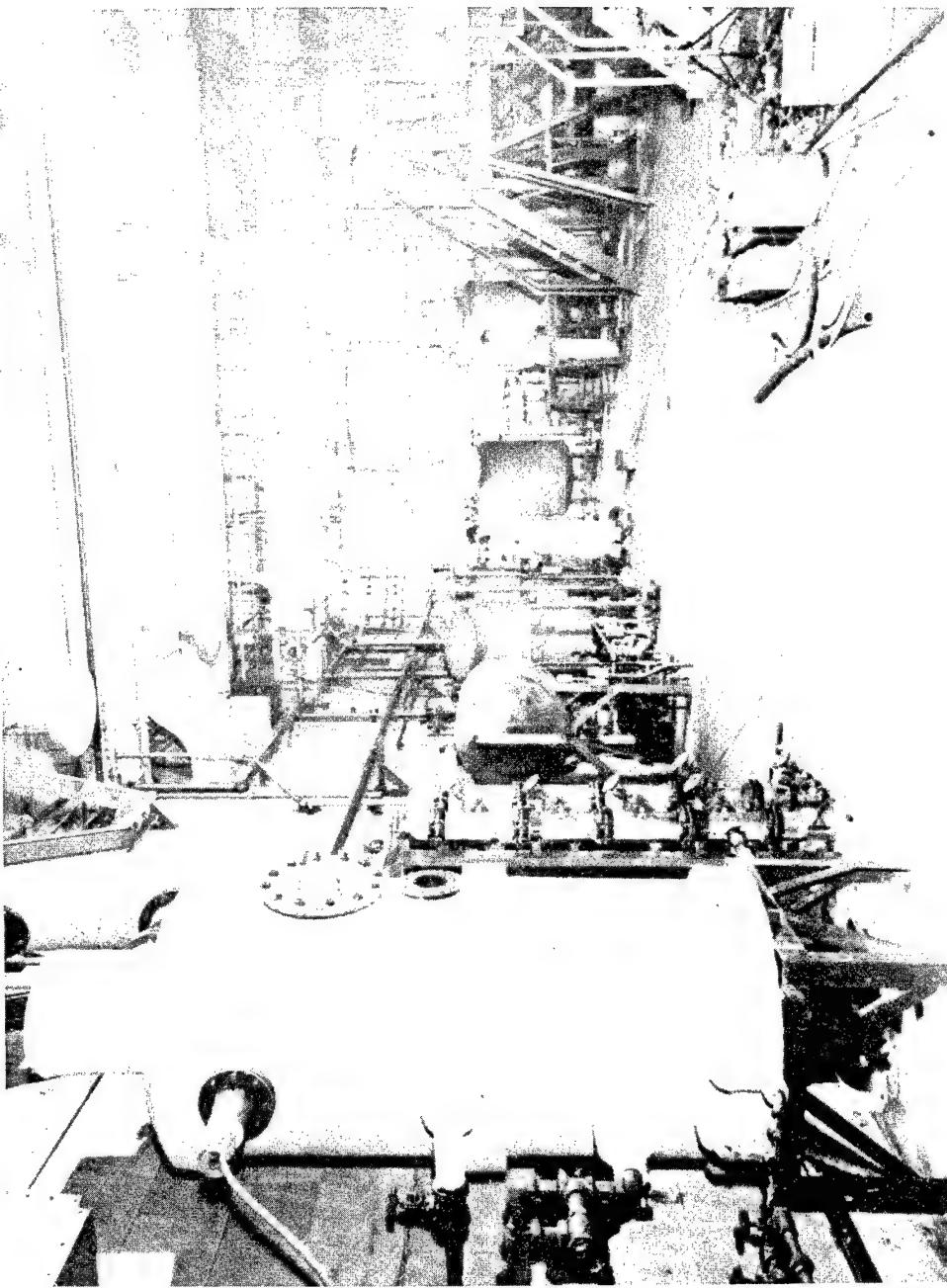


FIGURE 5. AMMONIUM PHTHALATE EVAPORATOR, MISCELLANEOUS HEAD TANKS IN BACKGROUND - FOURTH FLOOR

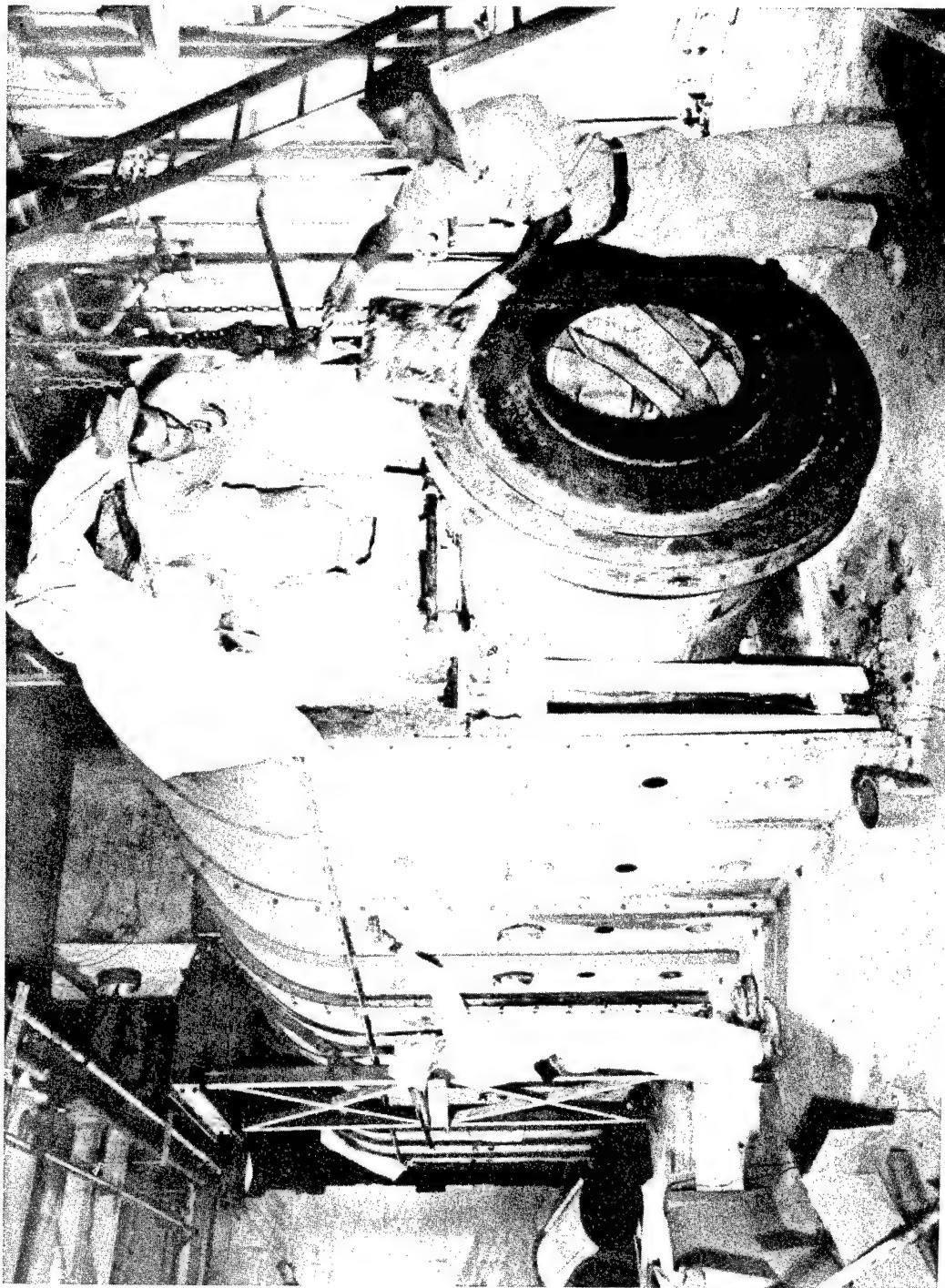


FIGURE 6. ASSEMBLY WORK ON DRIER - THIRD FLOOR

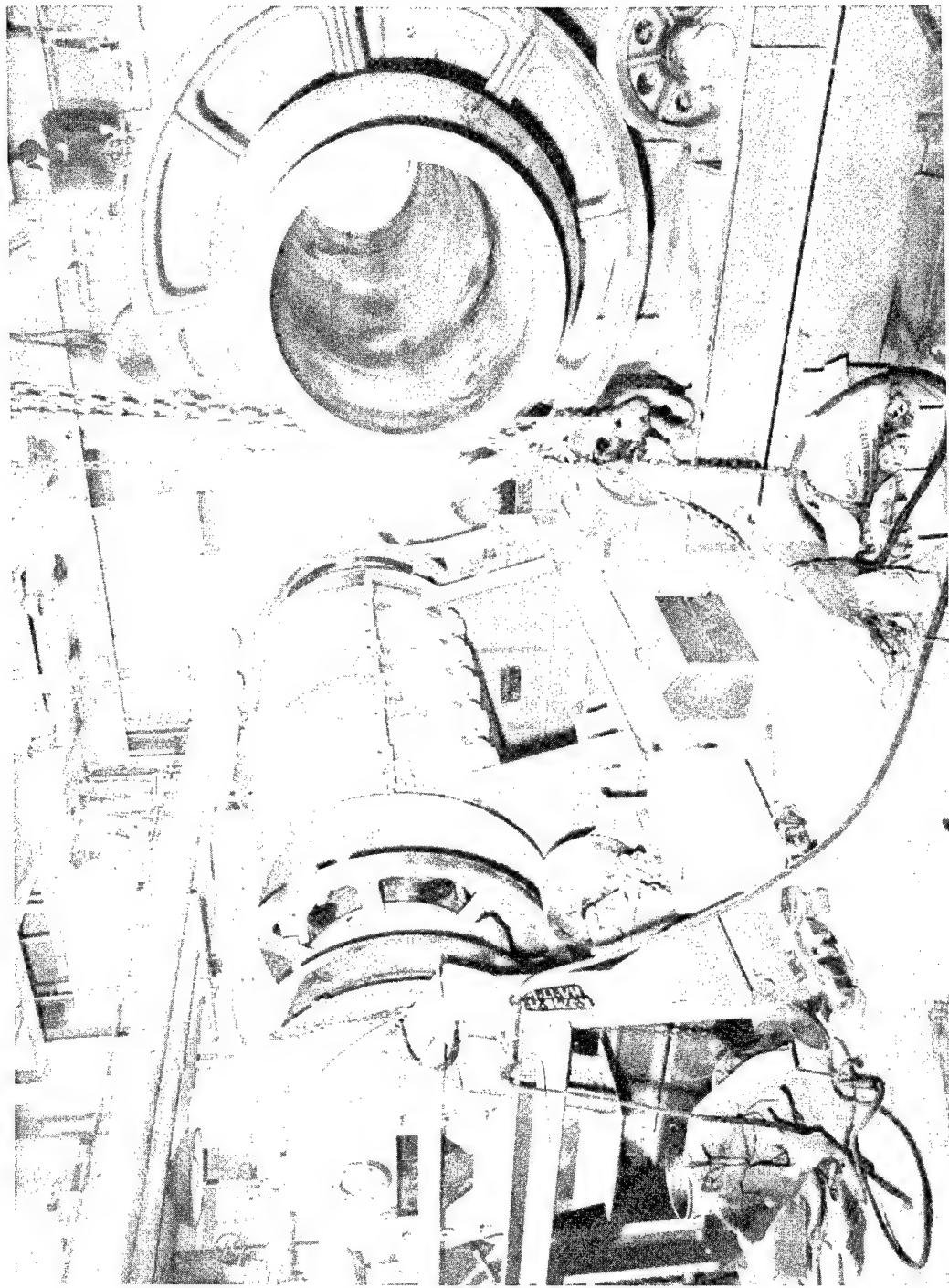


FIGURE 7. CALCINERS - SECOND FLOOR.

used for zirconium hydroxide. Some of the equipment in which this work is carried out may be seen in Figure 8, "Hafnium Purification Equipment."

Chlorination

The method of chlorination that was used at Y-12 consisted of direct chlorination of the oxide with carbon tetrachloride in a rotary horizontal reactor. Zirconium oxide was charged batchwise into the reactor. Carbon tetrachloride was fed through a vaporizer into the rotary reactor forming volatile zirconium tetrachloride. The zirconium tetrachloride gas was collected in an air-cooled condenser and cleaned batchwise into shipping containers. The reaction gases were scrubbed in a sodium hydroxide system, (Figure 9, "Control Panel and Condensers of Horizontal Chlorinators - First Floor").

MATERIALS OF CONSTRUCTION

Handling of Process Materials

General selection of materials of construction at various stages of processing is given in Table I, "Materials of Construction for Handling of Process Materials". This table gives the actual construction of the permanent zirconium plant. Selection has been made based on chemical resistance to process solutions of various materials, and availability of standby equipment at Y-12.

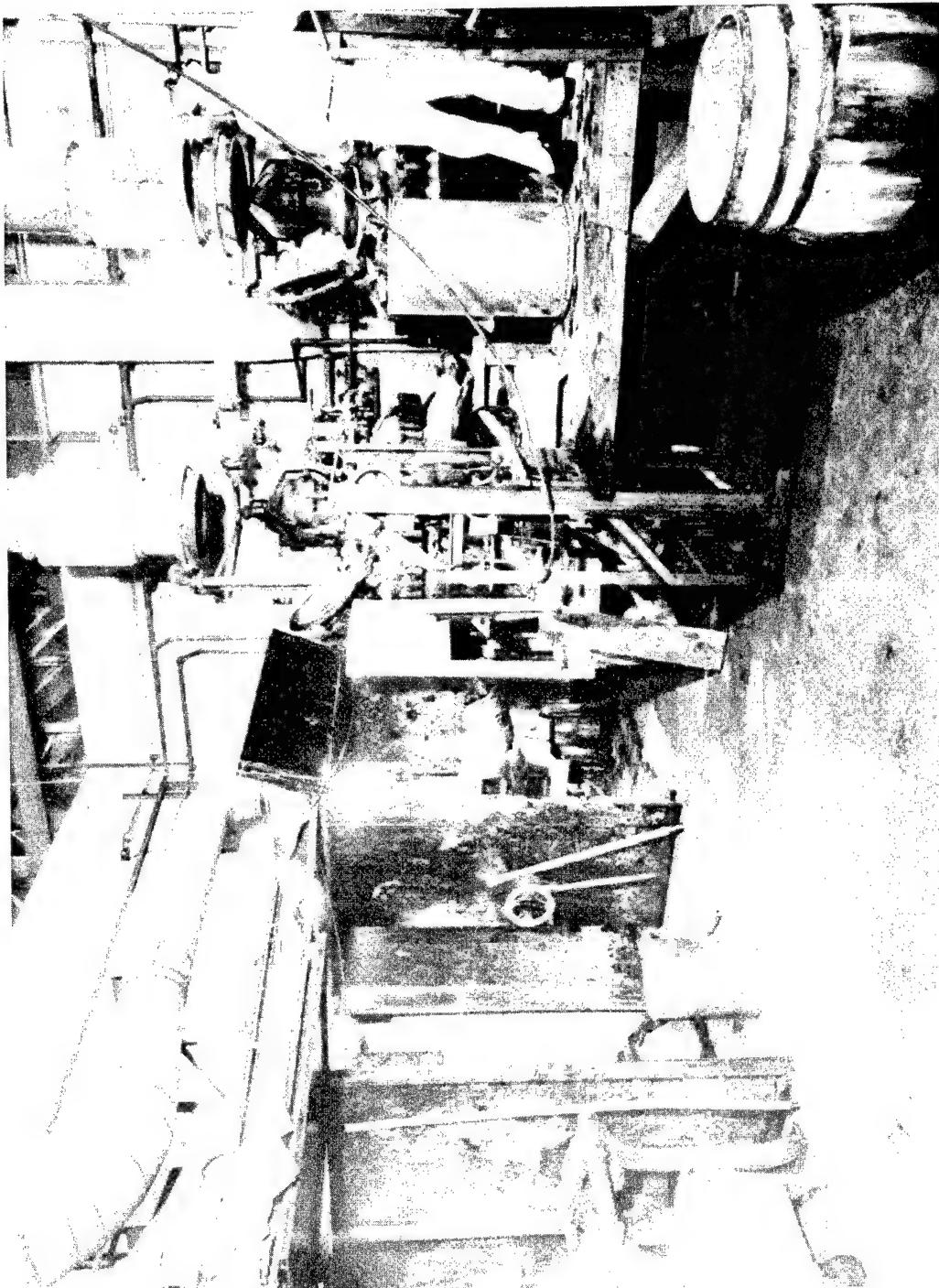


FIGURE 8. HAFNIUM PURIFICATION EQUIPMENT

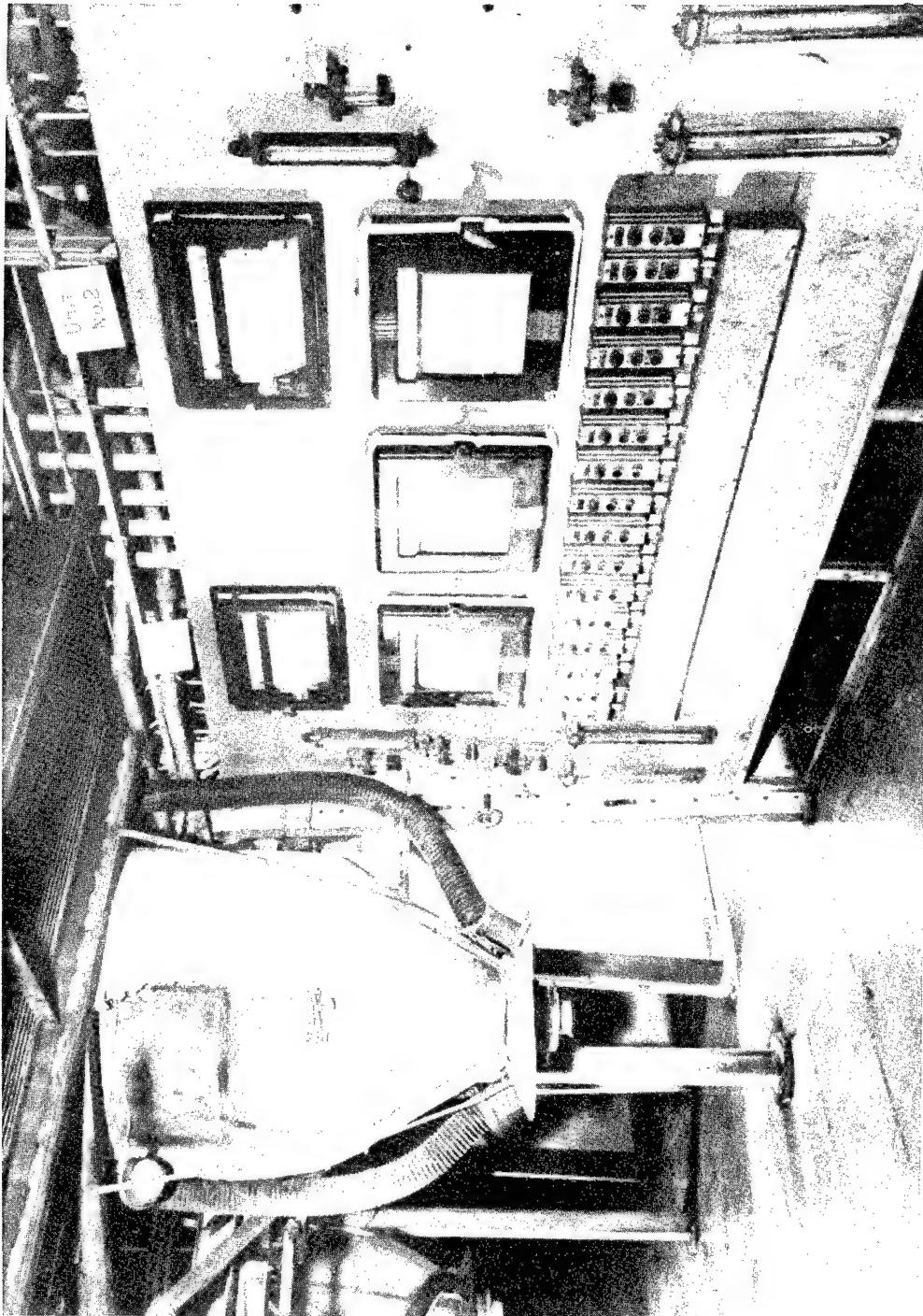


FIGURE 9. CONTROL PANEL AND CONDENSERS OF
HORIZONTAL CHLORINATORS -FIRST FLOOR

TABLE I
MATERIALS OF CONSTRUCTION FOR HANDLING OF PROCESS MATERIALS

Tanks and Equipment	Pipe	Valves	Diaphragms	Pumps	Gaskets	Packing	Pump Lubrication
<u>EXTRACTION</u>							
Aqueous Extraction Solution. and Stripping Solution (0.2-0.5 mol HCl)	Glass-lined, Rubber-lined Glass	Glass-lined	Tygon, Neoprene	Durchlor, Hastelloy C	Koroseal, Neoprene	Teflon, Durco 400-B	Nordoseal 755-S Rockwell Mfg. Co., Pittsburgh
Hexane (Acid)	Glass-lined, Stoneware	Glass-lined	Neoprene	Durchlor, Hastelloy C	Neoprene	Teflon, Durco 400-B	Nordoseal 755-S
Hexene (Neutral)*	Glass-lined, Stoneware	Glass-lined	Butyl Rubber Neoprene	-	Butyl Rubber, Neoprene	Teflon, Durco 400-B	Nordoseal 755-S
Sulfuric Acid (5 Mol)	Glass-lined Glass	Glass-lined	Tygon	-	Koroseal	Teflon	Nordoseal 755-S
Sulfuric Acid (Pore.)	Black Iron	Black Iron	-	Black Iron, Carpenter 20 SS	-	Teflon	Nordoseal 755-S
Cone. HCl (for Stripper Makeup)	Glass-lined Glass	Glass-lined	Tygon	Havoc	Koroseal	Teflon	Nordoseal 755-S
<u>PURIFICATION</u>							
Extraction Effluent	Glass-lined, Wood, Hastelloy C, Rubber-lined	Glass*, Hard Rubber	Glass-lined, Rubber-lined	Durchlor Hastelloy C	Koroseal	Teflon	Nordoseal 755-S
Ammonium Phthalate Solution	SS 316	SS 316	SS 316	SS 316, Black Iron	Koroseal	Asbestos	Nordoseal 755-S
Drying (to 300°c)	SS 316	Fused Quartz	-	-	-	-	Nordoseal 755-S
Calcinating (to 700°c)	-	-	-	-	-	-	Nordoseal 755-S
<u>CHLORINATION</u>							
CCl ₄	SS 316	Black Iron	Black Iron	-	-	Asbestos	Nordoseal 755-S
ZrCl ₄ Gas (above 350° c)	Carbon, Quartz	-	-	-	-	-	-
ZrCl ₄ Solid (below 350° c)	Nickel	-	-	-	-	-	-

* Protection against acid is made since possibility of acid condition exists in most cases. Pure hexene is a good organic solvent but is not corrosive.

Background for selection is given in a report, Y-589, "Corrosion Study for a Chemical Processing Plant", Frank A. Knox, August, 1950.

In general it is found that HCNS in hexone is corrosive to about the same extent as HCl. Metals which can be used to resist this combination are Hastelloy C and Durechlor. Various rubber-like materials may be used for gasket material, although hexone is a solvent for many gasket and diaphragm materials. Butyl rubber and Neoprene appear to be the most satisfactory for resistance to neutral hexone. A large amount of process piping is standard Pyrex glass with flange fittings; this gives resistance to most of the process solutions and also provides visibility.

For resistance to sulfuric acid, glass has been used for dilute solutions. Concentrated sulfuric acid is handled in black iron, and carpenter 20 stainless steel is used as piston material in a metering pump where the piston is alternately exposed to sulfuric acid and the atmosphere.

Concentrated hydrochloric acid is handled in glass-lined tanks and glass piping. A Haveg metering pump is used for metering concentrated hydrochloric acid. Chemical resistance is good, although mechanical properties are not as satisfactory as desired.

In the phthalate purification step, an acid-resistant filter of wood is being

used. It is indicated at this time that a totally rubber-covered steel filter might be more suitable. Filter media for hydrochloric acid solutions is high temperature Vinyon or Dynell. Particle size is small and a tight weave is required.

The dryer is constructed of 316 stainless steel, which has been shown in the laboratory to be satisfactory up to 300 degrees Centigrade from the corrosion standpoint. Extensive tests on metals for calcining zirconium oxide failed to show a satisfactory metal. A fused quartz lined calciner was developed for this application in conjunction with the Bartlett-Snow Company, the Amersil Company, and the General Ceramics Company. Efficiency of this equipment will be shown by operation.

Materials of construction for zirconium chlorination are limited for zirconium tetrachloride in the gas phase. Fused quartz has been found to be resistant at very high temperatures. Carbon is good in the range of 350 to 650 degrees Centigrade. Nickel is good at 350 degrees Centigrade and below, and is fairly satisfactory up to 550 degrees Centigrade, although it gives some contamination in this range.

General Protection Against Corrosion

Operation of the temporary zirconium plant showed that a severe corrosion

problem can result from vapors of process solutions in the extraction and purification plants. However, general corrosion can be controlled by taking proper protective measures.

Structural supports for extraction columns are fabricated from 316 stainless steel angle and non-reusable stainless steel pipe. This stands up with only surface discoloration under the conditions present, that is, spills of dilute hydrochloric acid and vapors of HCl under oxidizing conditions.

Filters are completely enclosed and ventilated. Hoods for filters are constructed of 1/2 inch marine plywood and coated with one coat of Penkote protective coating.¹ Glass pipe flanges on the columns are cast iron coated with seven layers of a baked phenolic resin coating.² Nuts and bolts on flanges of columns are of stainless steel 316.

Duct work for feed makeup exhaust system is fabricated of 316 stainless steel coated with baked on Heresite. Duct work for exhaust on filter hoods is fabricated from mild steel coated with baked Heresite.

¹ Penkote 500, Peninsular Chemical Product Company, Van Dyke, Mich.

² Heresite P403, Heresite Chemical Company, Manitowoc, Wis.

PROCESS CONDITIONS AND EFFICIENCYExtraction

Present operating conditions for the extraction columns are outlined as follows:

Length of Columns (Total)

Extraction	180 Ft.
Stripping	125 Ft.
Scrubbing	65 Ft.
Thiocyanate Recovery	55 Ft.
Hexone Rate	140 GPH
CNS Concentration in Recycle Hexone	2.7 Molar
HCl Rate, Stripping Section	18-20 GPH
HCl Concentration	3.5 Molar
CNS, Concentration In	0.0 Molar
CNS, Concentration Out	2.5-3.0 Molar
Feed Rate, Zirconium Oxychloride Solution	50 GPH
HCl Concentration	1 Molar
HCNS Concentration	2.6 Molar
Zr Concentration	1#/gal.
H ₂ SO ₄ Rate, Scrubber Solution	35 GPH
H ₂ SO ₄ Concentration	5 Normal
CNS Conc., Feed to Thiocyanate Recovery Column	1.60 Molar
CNS Conc., Discharge from Thiocyanate Recovery Column	0.1 Molar
CNS Conc., Hexone to Column	0.0 Molar
CNS Conc., Hexone from Column	2.50 Molar
Rate of Hexone to Thiocyanate Recovery Column	40 GPH
Rate of Aqueous Solution in Column	70 GPH
Conc. Hf in Raw Feed	1.5-2.0 %
Conc. Hf in Product Zr	<100 PPM
Conc. Zr in Product Hf	Approximately 2 %

Yield of Zr Product Based on Feed Solution	96%
Percent Recycle of Hexone	96.5-97.0 %
Percent Loss of Hexone	3-3.5 %
Amount Makeup Hexone	90 Gals/day
<u>Optimum for Extraction Section</u>	<u>Optimum for Stripping Section</u>
Distribution Coefficient Hf Org/Aq	1.5
Distribution Coefficient Zr Org/Aq	0.3
Separation Factor	4-5

Operation of the extraction units is carried out to achieve the best balance between product purity and yield of zirconium. Increased purity of zirconium can be obtained at the expense of yield and Hf purity. With the present method of operation it is possible to obtain a yield of better than 96% of Zr containing less than 100 ppm Hf while obtaining hafnium product containing between 0.5% and 3.0% Zr.

Purification

Efficiency of the purification plant has not yet been established, and it is expected that considerable process improvement work will be required to obtain maximum efficiency. It is expected that 98 % yield of zirconium will be obtained and that product purity will be equal to, or better than, purity of product

from the initial installation based on batch operation.

Phthalate recovery is expected to be about 80 percent. Recovery efficiency is very dependent on filter operation and wash distribution on the filter.

Recycle of ammonium hydroxide from the evaporator may be a practical step for economy. It is planned to add fractionating and condensing equipment for recovery and recycle of ammonium hydroxide if it is economically justified.

Drying and Calcining

Operating experience with the rotary equipment is limited but serious dust losses are not anticipated. Available rotoclones and scrubbers will be activated if necessary.

Operating Costs

Typical operating costs are given in the following tables. Table II gives the cost for ZrO₂ production in the month of January, 1951. Table III gives cost for ZrO₂ production total for the fiscal year July, 1950 through April, 1951.

These costs resulted from operation of the temporary zirconium production

facilities. Considerable economies in both labor and materials are expected from operation of the permanent zirconium plant. Estimated costs in report Y-573, p10, are expected to be in line with actual cost if allowance is made for general price advances.

TABLE IIUNIT COST OF ZRO₂ PRODUCTION, JANUARY, 1951

Total	Cost Per Pound Zr Produced
\$93,523	\$3.002

Material

Ammonium Hydroxide	1584	.051
Lime	133	.004
Hydrochloric Acid	1874	.061
Salicylic Acid	38934	1.251
Sulfuric Acid	658	.021
Ammonium Thiocyanate	10057	.323
ZrCl ₄	35165	1.129
Hexone	2186	.070
Natural Gas	693	.022
Steam	1534	.049
Treated Water	536	.017
Electricity	134	.004
Operating Labor, Direct	13,667	.439
Maintenance, Labor, & Material	15,763	.506
Allocated Plant Expense	12,455	.400
Analytical	3,740	.120
Miscellaneous *	9,128	.293
Total	\$148,276	\$4.761

Pounds Zirconium as Oxide Produced - 31,134

* Protective Clothing, Shipping Charges, Janitorial Services, Etc.

TABLE III

**UNIT COST ZRO₂ PRODUCTION FROM JULY, 1950 THRU
APRIL, 1951**

<u>Material</u>	<u>Total Cost</u>	<u>Cost/lb.</u>
	<u>\$731,971</u>	<u>\$2.943</u>
Ammonium Hydroxide	\$13,041	.052
Lime	1,710	.007
Hydrochloric Acid	22,408	.090
Salicylic Acid	278,764	1.121
Sulfuric Acid	3,679	.015
Ammonium Thiocyanate	89,211	.359
ZrCl ₄	287,050	1.154
Hexone	14,985	.060
Caustic Flake	41.	.000
Natural Gas	5,807	.023
Steam	10,821	.044
Treated Water	3,280	.013
Electricity	1,174	.005
Operating Labor	110,385	.443
Maintenance, Labor, & Material	148,453	.596
Allocated Plant Expense	124,067	.498
Analytical	33,471	.135
Miscellaneous	88,920	.357
Total	\$1,237,267	\$4.972

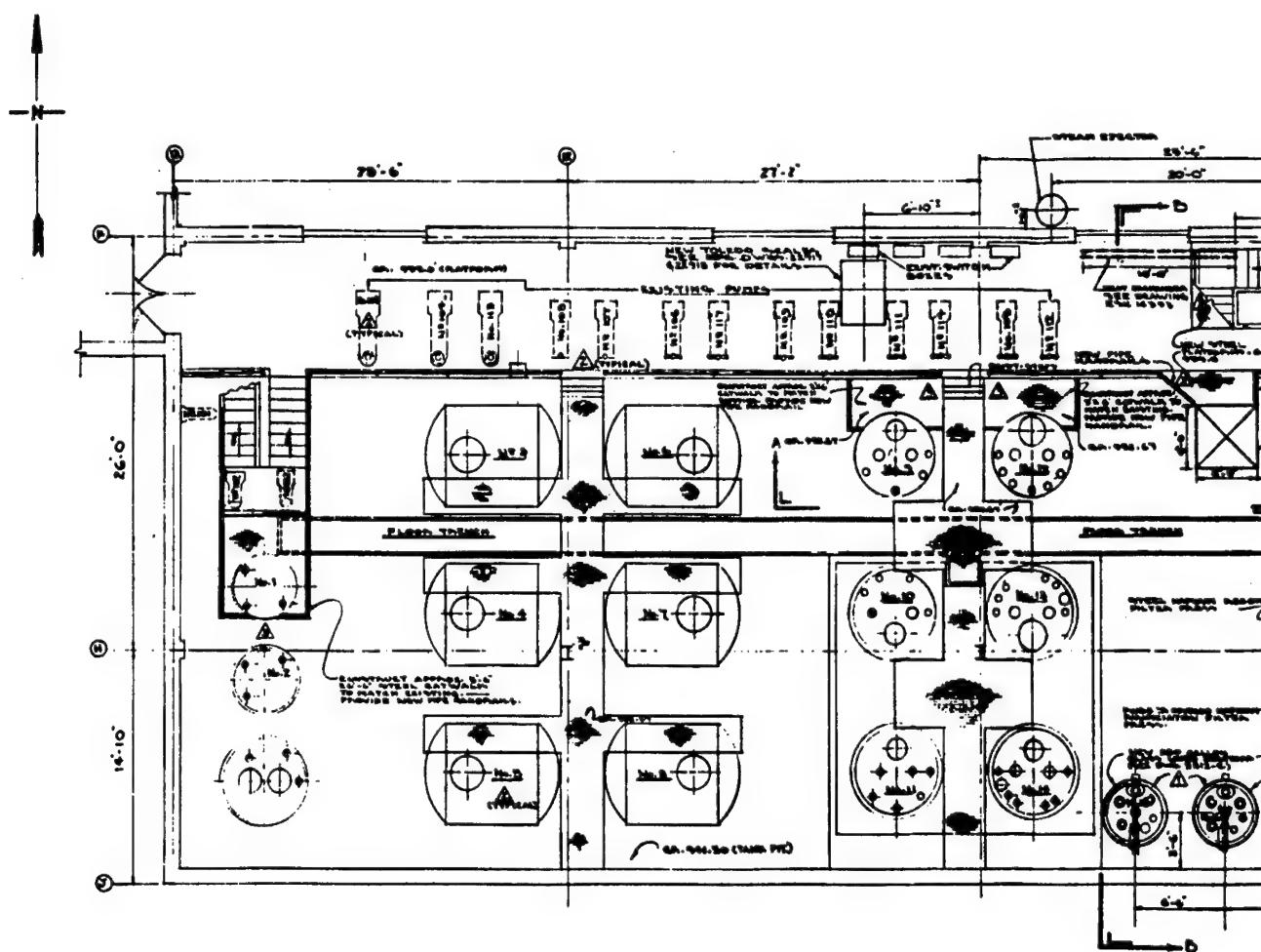
Pounds Zirconium as Oxide Produced - 248,751

BIBLIOGRAPHY OF Y-12 LITERATURE BEARING ON PRODUCTION OF ZIRCONIUM MATERIALS

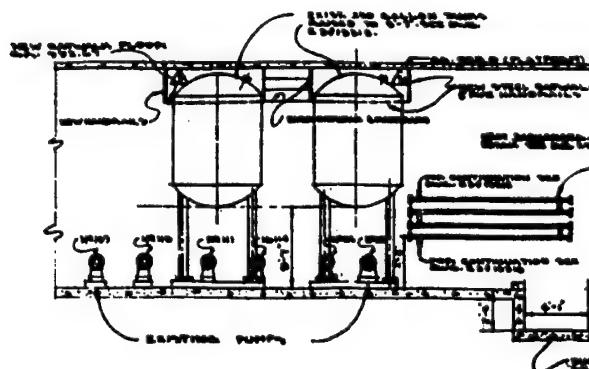
Bibliographies of Y-12 reports and reports of the MIT Practice School (Y-B4-43 and Y-B4-44) have been prepared by Mrs. Frances Sachs of the Y-12 Technical Information Center. Reports listed in these bibliographies contain important background material regarding the present processes for extraction, purification, and chlorination of zirconium materials at Y-12.

CONSTRUCTION DRAWINGS

Reduced drawings are given of principal engineering designs used in construction of the permanent zirconium plant. Drawings were prepared by Mr. F. S. Patton of the Engineering Department at Y-12 and were used as the basis of field instruction to construction personnel.

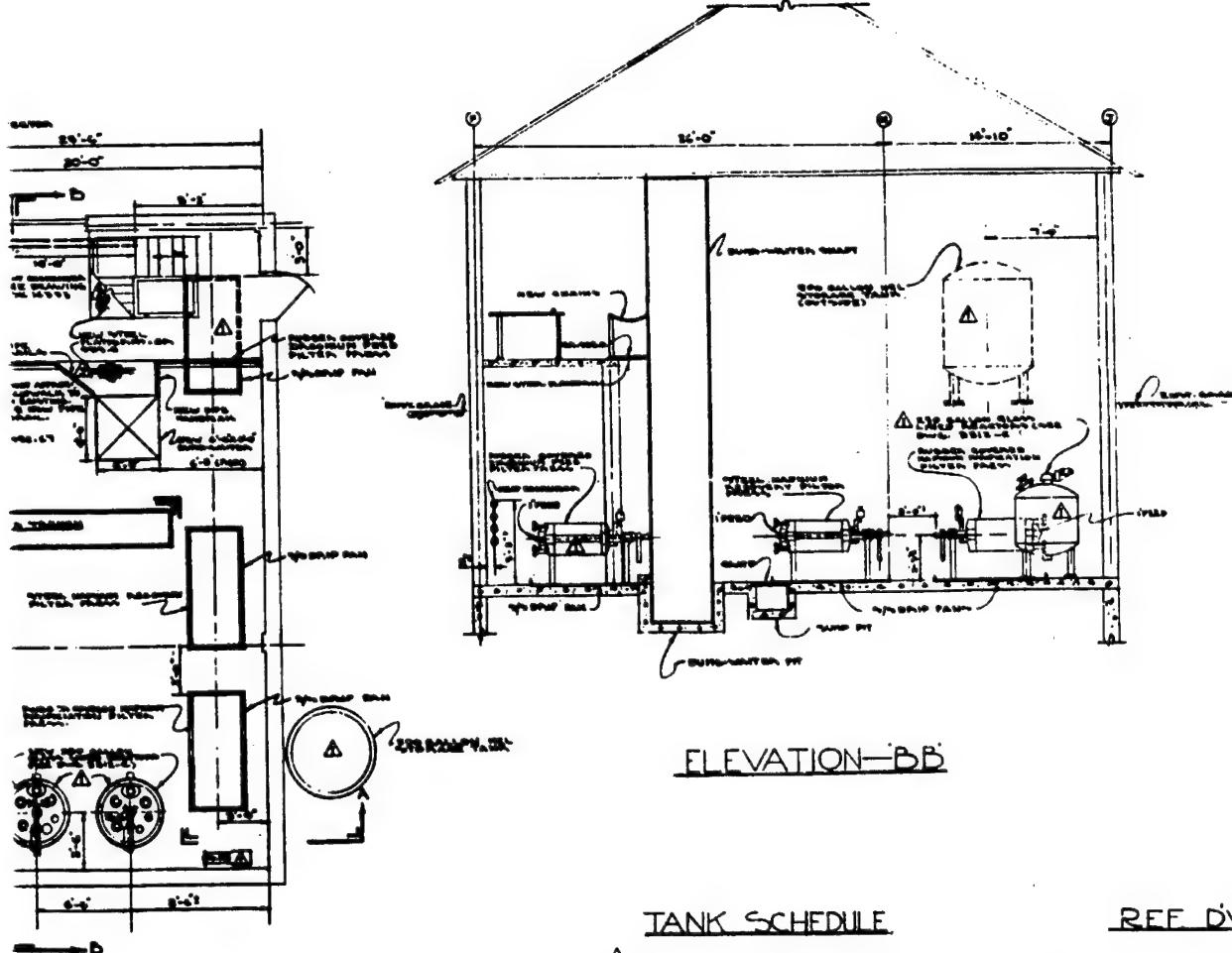


TANK FARM PLAN



ELEVATION-AA

PERMANENT ZIRCONIUM PLANT EQUIPMENT LOCATIONS

TANK SCHEDULE

▲
 1.6.748 — PHthalate STORAGE
 1 — PIGS
 2 — FEED STORAGE
 34 5 — PRODUCT STORAGE.
 34.12.213 — FEED MAKEUP AREA
 11.16.19.6 — HAPNUHM

REF DWGS.

2.11.19.6 — PERMANENT ZIRCONIUM PLANT
 FEED MAKEUP AREA — PLOW DIAGEAR.
 2.10.19.46 — PERMANENT ZIRCONIUM PLANT
 FEED MAKEUP AREA — LUCITE COVERS.
 2.11.19.9 — PERMANENT ZIRCONIUM PLANT
 FEED MAKEUP AREA — HEAT EXCHANGER.
 2.10.19.5 — PERMANENT ZIRCONIUM PLANT
 FEED MAKEUP AREA — FEED SUMMIT SYSTEM.
 2.11.19.6 — PERMANENT ZIRCONIUM PLANT
 FEED MAKEUP AREA — CALCIATE SUMMIT SYSTEM.
 2.10.19.7 — PERMANENT ZIRCONIUM PLANT
 FEED MAKEUP AREA — CALCIATE EXHAUST HOOD
 2.11.19.8 — TYPE E.C. FILTER PRESS, D.C.
 2.10.19.9 — 100 GALLON REACTOR, GLAM
 COTE PRODUCTS, INC.
 2.29.1 — PIT LAYOUT — TYPE 9900 — TOLEDO
 SCALES
 2.29.2 — FRAME DETAILS — TYPE 9900
 TOLEDO SCALES

PUMP SCHEDULE

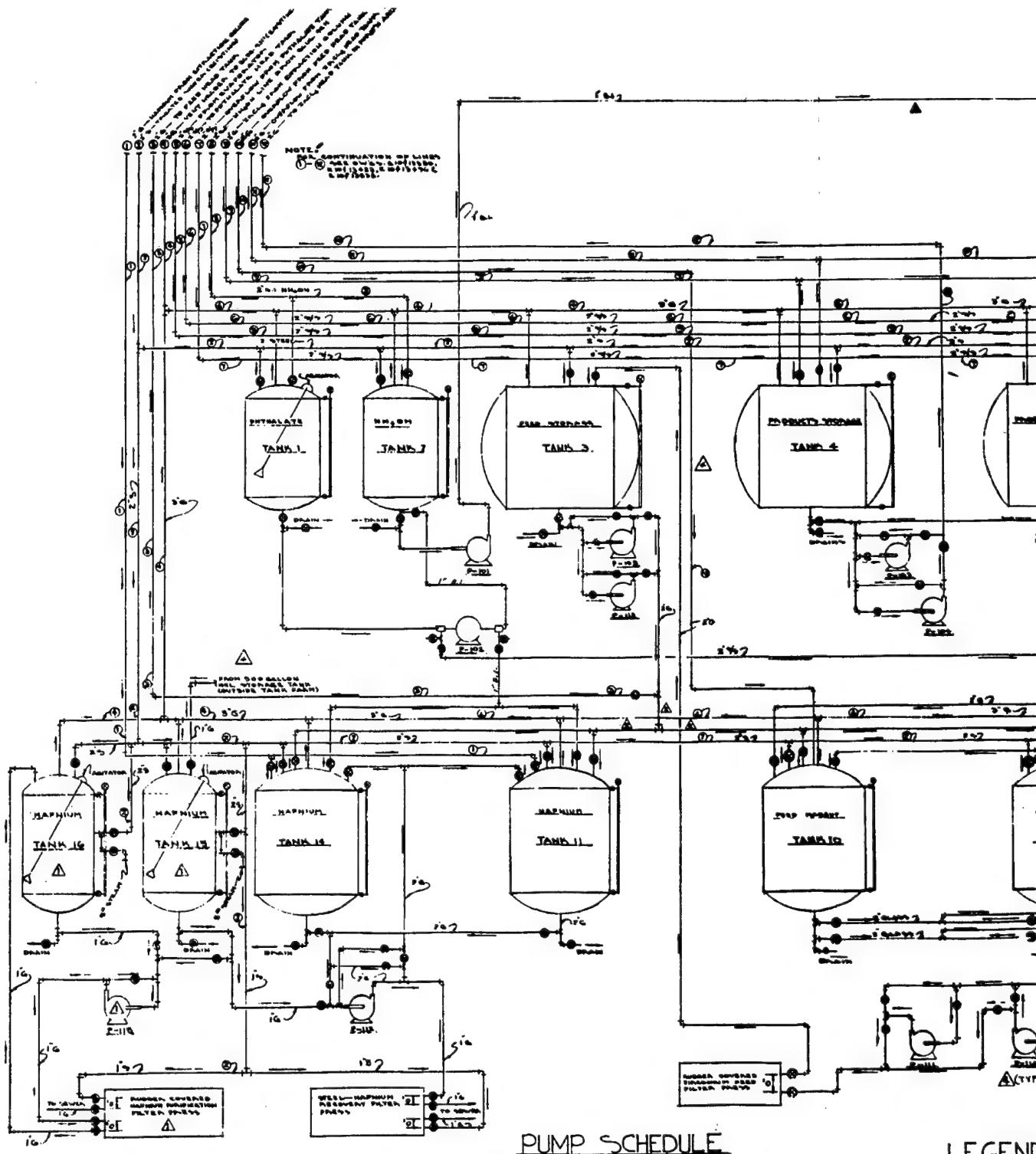
▲
 P—101 DURCHELOR MODEL X-2000-100 — 10HP
 P—102 PROPORTIONER, DUPLEX — 10HP
 P—103 DURCHELOR MODEL X-2000-100 — 10HP
 P—104 DURCHELOR MODEL X-2000-100 — 10HP
 P—105 DURCHELOR MODEL X-2000-100 — 10HP
 P—106 DURCHELOR MODEL X-2000-100 — 10HP
 P—107 DURCHELOR MODEL X-2000-100 — 10HP
 P—108 DURCHELOR MODEL X-2000-100 — 10HP
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 P—112 DURCHELOR MODEL X-2000-100 — 10HP
 P—113 DURCHELOR MODEL X-2000-100 — 10HP
 P—114 DURCHELOR MODEL X-2000-100 — 10HP
 P—115 DURCHELOR MODEL X-2000-100 — 10HP
 P—116 DURCHELOR MODEL X-2000-100 — 10HP

GEN. NOTES

1. DIMENSIONS SHOWN MAY BE VARIED TO MEET FIELD CONDITIONS.
2. Existing equipment shown in light lines while new equipment is in heavy.
3. FILTERS TO BE EQUIPPED WITH ANTI-TIE WHEEL CLIPS FROM CONSTRUCTION IN FIELD.
4. POLE FRAME & PIT DETAILS OF TOLEDO SCALE SEE MANUFACTURERS DRAWINGS & ETC.
5. SEE LOCATION OF SCALE ON DRAWING SHEET 14067.
6. DUMB WATER REMOVED FROM 100 GALLON REACTOR INSTALLED IN BUILDING 2111. SEE INSTRUCTIONS FOR BOTH IN NO. 00075.
7. POLE EXCAVATED TO FEED MAKEUP AREA SEE DWG 2111 SHEET 14067, ETC.

IMPLEMENT LOCATION-FEED MAKEUP AREA, PLAN & ELEVATIONS

(2)



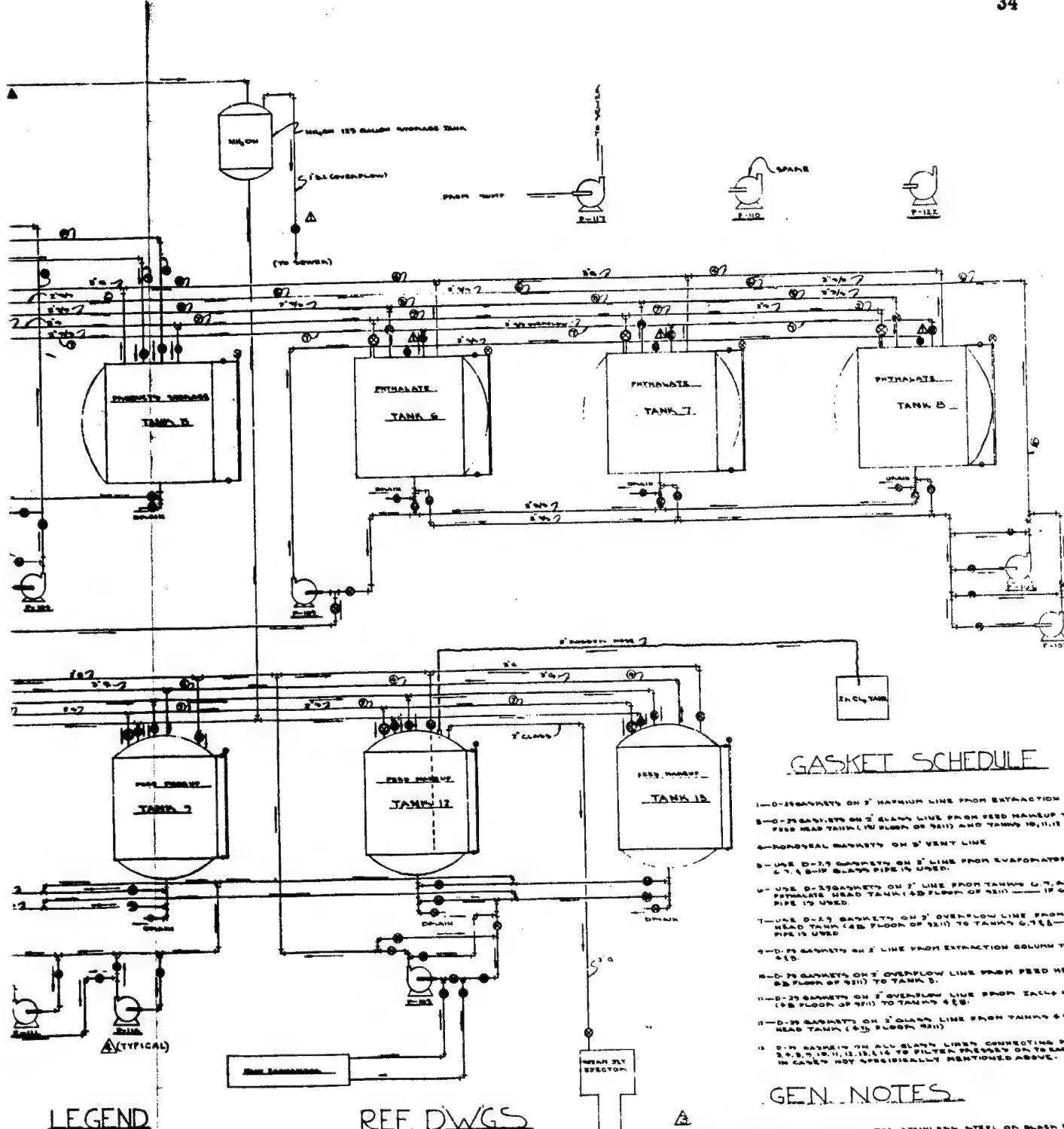
PUMP SCHEDULE

PIPE MARK SCHEDULE

1 — 2" GLASS — PHENOLIC LINE FROM EXTRACTION COLUMN (NEW)
 ① — 2" STEEL — TREATED WATER SUPPLY FROM BLDG. 3000 (NEW)
 ② — 2" GLASS — FROM MAKEUP TANK TO FEED HEAD TANK (NEW)
 ③ — 2" GLASS — VENT HEADERS TO BLDG. 3000 (NEW)
 ④ — 2" STEEL — FROM EVAPORATOR TO TANKS 6,7,8 & NEW
 ⑤ — 2" STEEL — TO PHENOLIC HEAD TANK FROM TANKS 6,7,8 (NEW)
 ⑥ — 2" STEEL — FROM PHENOLIC HEAD TANK TO TANKS 6,7,8 (NEW)
 ⑦ — 2" IRON — PHENOLIC LINE FROM BLDG. 3000 (NEW)
 ⑧ — 2" GLASS — ZINC LINE FROM EXTRACTION COLUMN TO TANKS (NEW)
 ⑨ — 2" GLASS — OVERFLOW FROM FEED HEAD TANK / THIOCIANATE RETURN LINE
 ⑩ — 2" GLASS — OVERFLOW FROM FEED HEAD TANK TO TANKS 6,7,8 (NEW)
 ⑪ — 2" GLASS — FROM TANKS 6,7,8 TO ZINC HEAD TANK (NEW)

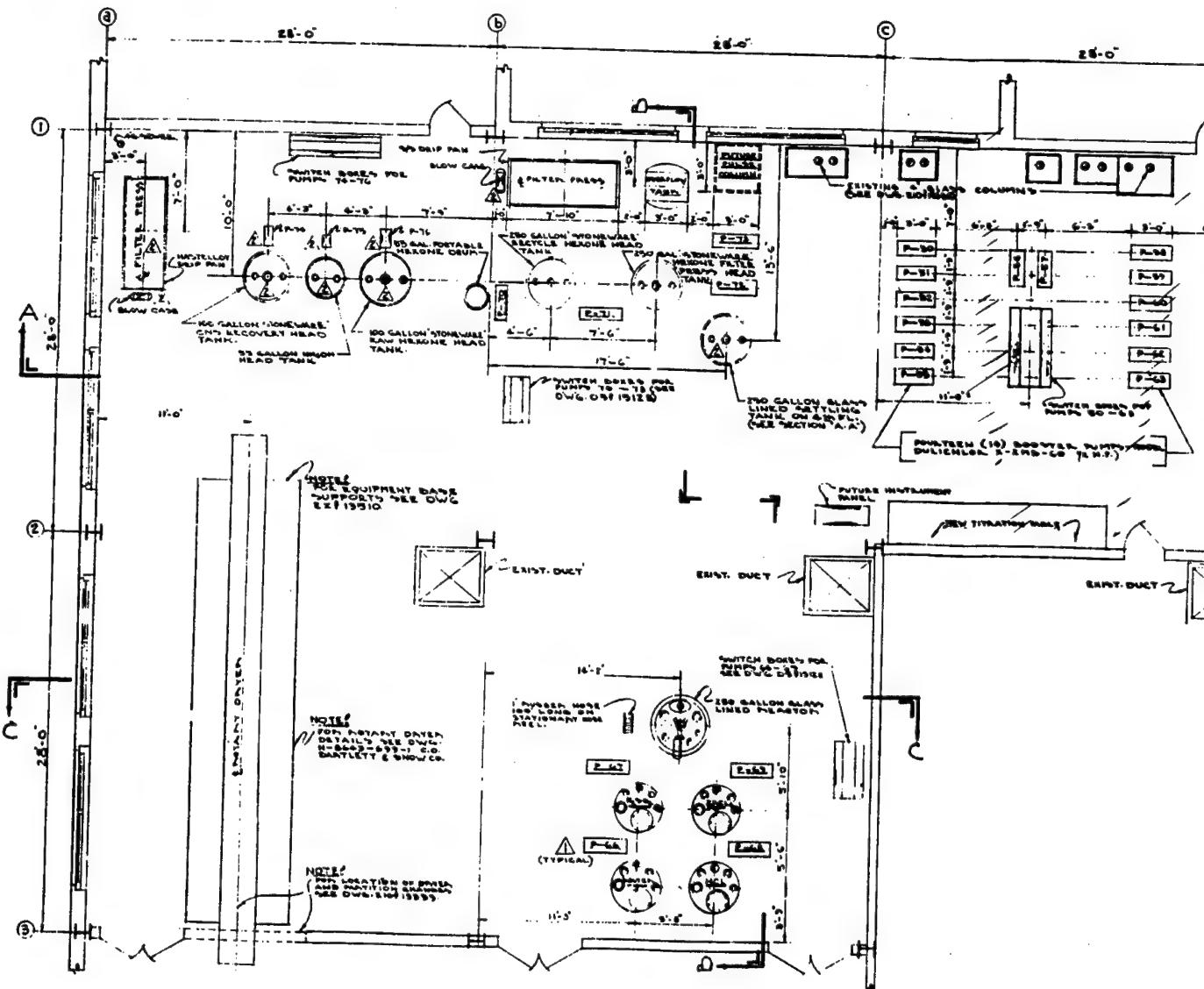
▲ — 101 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 102 BURKHOLDER, DUPLEX PUMP (10HP)
 ▲ — 103 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 104 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 105 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 106 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 107 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 108 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 109 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 110 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 111 BURKHOLDER MODEL A-2000-100 (10HP)
 ▲ — 112 BURKHOLDER MODEL A-2000-100 (10HP)

—	INDICATED
●	INDICATED
○	INDICATED
△	INDICATED
■	INDICATED
□	INDICATED
① — ②	Pipe Number
③	Indicated Pipe Number

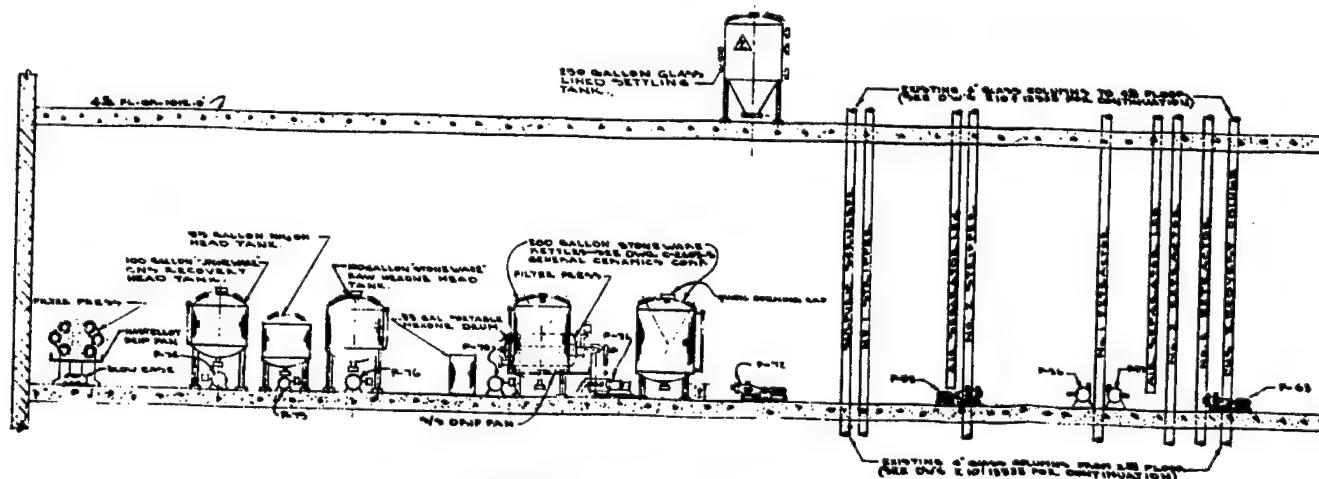


PERMANENT ZIRCONIUM PLANT FLOW DIAGRAM, FEED MAKEUP AREA

(2)

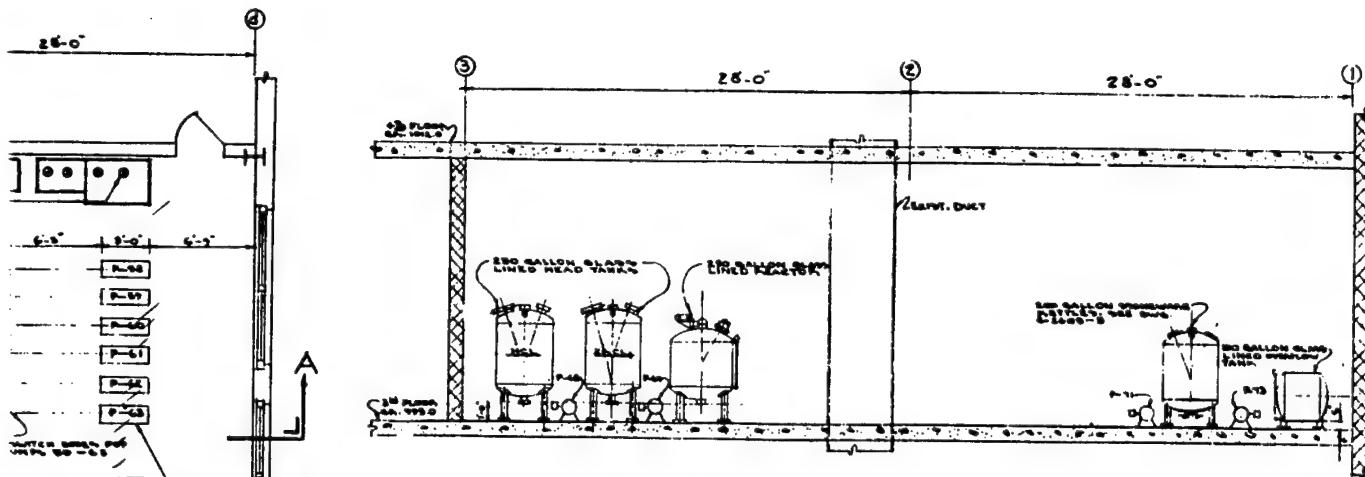


PART PLAN - 3rd FL
(EXCEPTION NOTED)

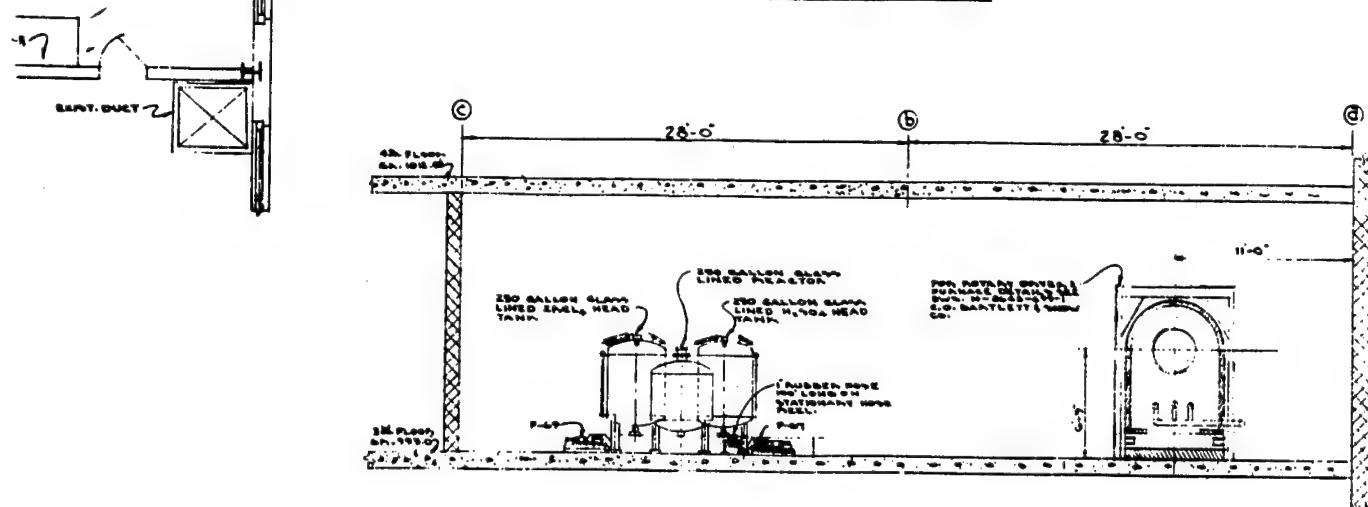


SECTION—A A

PERMAN



SECTION-BB

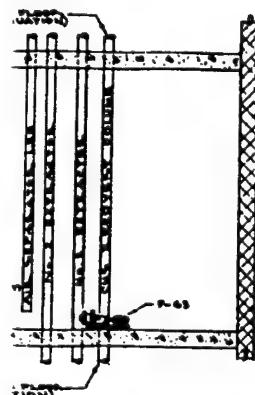


SECTION—CC

PUMP SCHEDULE

A

P-60-P-63 DURACOLOR XEMD-60 (10)
P-66 MILTON ROY DUPLEX
P-67 MILTON ROY SIMPLEX
P-68 MILTON ROY DUPLEX
P-69 MILTON ROY SIMPLEX (MILLER)
P-70 MILTON ROY SIMPLEX
P-71 MILTON ROY SIMPLEX
P-72 DURACOLOR XEMD-60 (10)
P-73 MILTON ROY SIMPLEX (MILLER)
P-74 DURACOLOR R-740 R-62
P-75 MILTON ROY SIMPLEX (70)
P-76 MILTON ROY SIMPLEX (MILLER)



REF. DWGS.

A

E101-13535 — PERMANENT ZIRCONIUM PLATE
EQUIPMENT LOCATION — PURIFICATION &
CALCING AREA — PLAN 4 — SECTION B

E101-13536 — PERMANENT ZIRCONIUM PLATE
FLOW DIAGRAM — EXTRACTION GRANULAT.

E101-13547 — PERMANENT ZIRCONIUM PLANT
PIPEING LAYOUT — EXTRACTION CONTROL

E-27 19510 — PERMANENT ZIRCONIUM PLANT
EQUIPMENT BASE — 3M FLOOR.

D7K HIGH — PERMANENT ZIRCONIUM PLANT
FILTER PRESS EXHAUST SYSTEM.

D-95 10128 — PERMANENT ZIRCONIUM PLANT
ONE LINE DIAGRAM — EXTRACTION
CONTROL AREA.

H-3433-679-1 — ROTARY DRYER — G.O.
BARTLETT & MOORE CO.

L.C. 18846 — SPERRY FILTER PRESS —
D.L. SPERRY & CO.

C-2005-5 — 200 GALLON STONEWARE
KETTLE — GENERAL CERAMICS CORP.

B812 — C 250 GALLON PLATE LINED
REACTOR — GLASCOTE PRODUCTS.

G7886-1 — 250 GALLON EFFLUENT HEAD
TANK ALLOY FABRICATORS, INC.

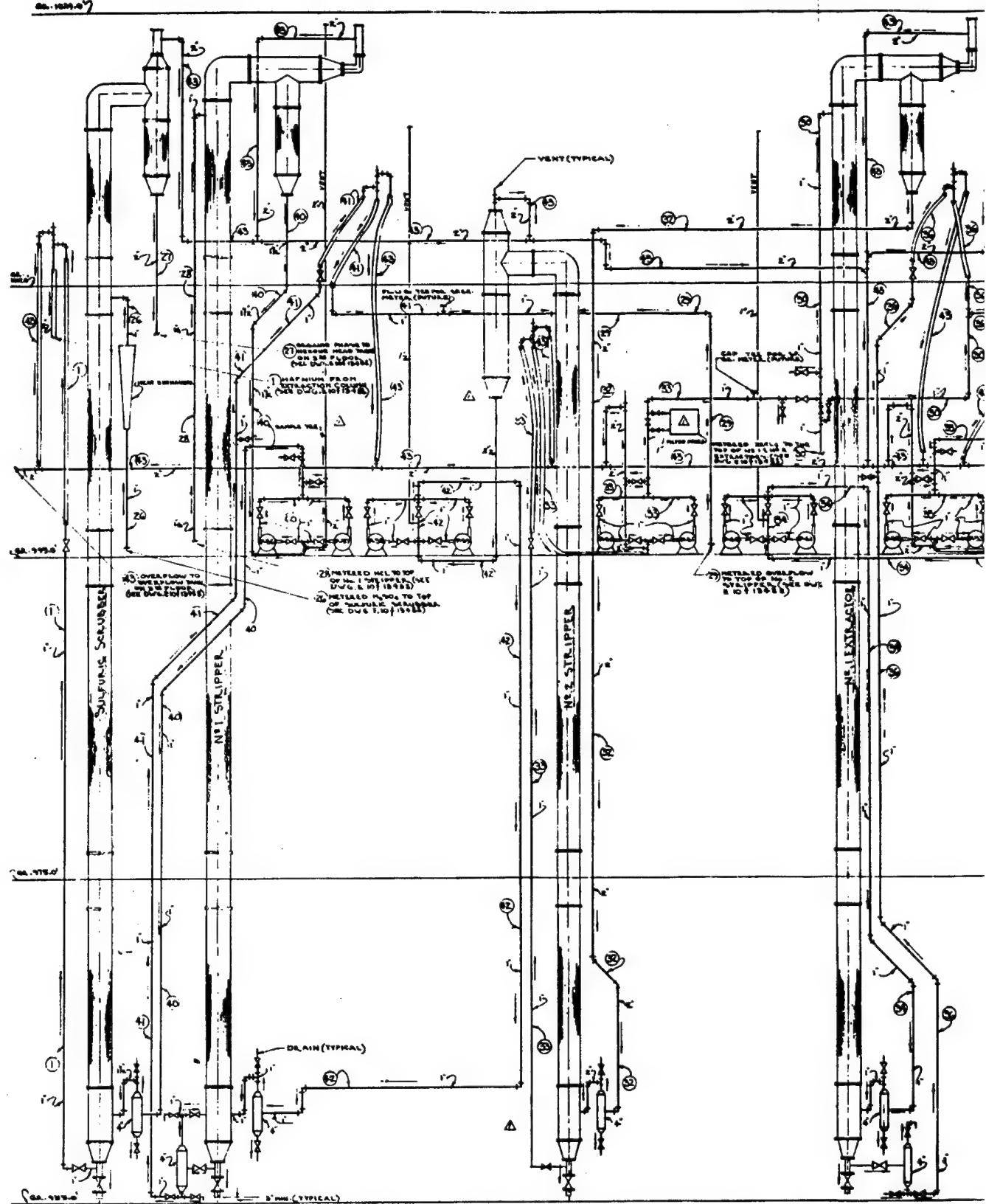
GEN NOTES

1

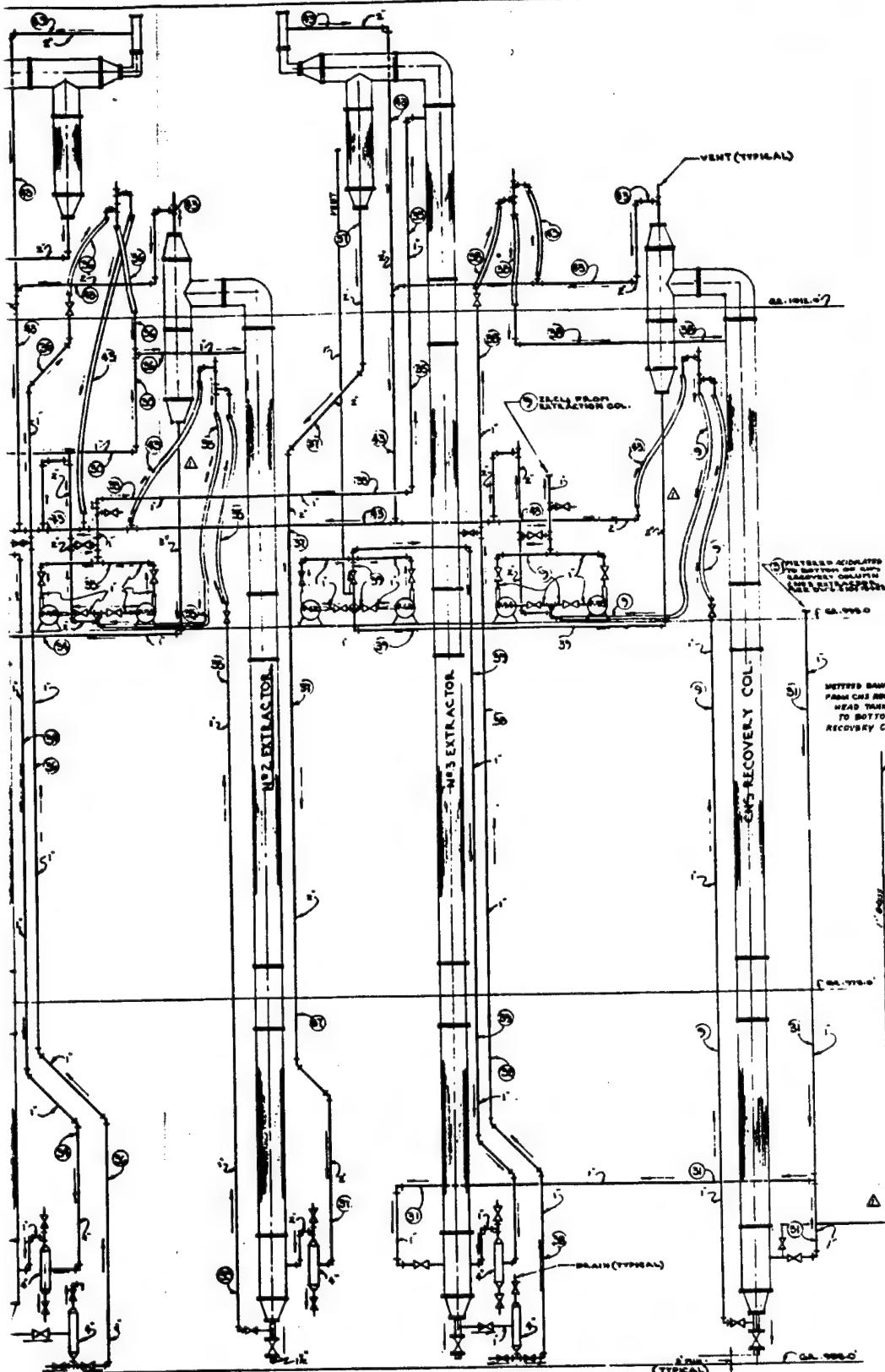
- 1 - ALL EQUIPMENT SHOWN ON BM PLANS TO BE NEW EXCEPT AS NOTED.
- 2 - ALL TANK SUPPORTS TO BE DESIGNED AND INSTALLED BY FIELD CONTRACTOR.
- 3 - DIMENSIONS SHOWN ARE APPROPRIATE AND MAY BE VARIED TO BEST FIELD CONDITIONS.
- 4 - BM PNEUMATIC DRAWDOWN FOR DESIGN OF CONTACT DRYER, FILTER PRE-HEATER, AND 1,000 GALLON HEAD TANKS.
- 5 - NEW DRAFT SYSTEMS TO BE PROVIDED - FIG. 110. LOCATION OF DRAFT SYSTEMS AND EXHAUST POINTS TO BE DETERMINED BY FIELD.
- 6 - ALL FILTERS TO BE EQUIPPED WITH EITHER STAINLESS STEEL OR MARSHFIELD FILTERS AS NOTED. SIZE AND CONSTRUCTION OF FILTERS TO BE DETERMINED BY FIELD.
- 7 - FILTRATION TABLE TO BE USED AS INDICATED BY FIELD.
- 8 - WRITEN SPEC'S FOR RUMPS SO-76 TO BE LOCATED APPROXIMATELY WHERE SHOWN, BUT MAY BE MOVED TO MEET FIELD CONDITIONS.
- 9 - EQUIPMENT PANEL (TURE) TO REFL. OPERATING GRAVITY ACTUALS.
- 10 - ALL TANKS TO HAVEIGHT CLAMPS, WHICH MAY BE ADDED OR REMOVED DEPENDENT UPON AVAILABLE SPACING.
- 11 - PER FILTER, FILTER EXHAUST SYSTEM SEE DUAL OUTLET.

PERMANENT ZIRCONIUM PLANT EXTRACTION CONTROL AREA EQUIPMENT LOCATION-PLAN & SECTION

4



GL-103307

PIPE MARK SCHEDULE

- ① METERED H2O2 THRU P-66 TO TOP OF THE SULPHURIC ACID STRIPPER.
- ② ORGANIC PHASE FROM TOP OF THE SULPHURIC ACID STRIPPER TO H2O2 HEAD TANK.
- ③ METERED HCl THRU P-66 TO TOP OF THE H2 STRIPPER.
- ④ METERED OVERFLOW THRU P-76 TO TOP OF THE H2 STRIPPER.
- ⑤ METERED ZACL THRU P-69 TO TOP OF H2 STRIPPER.
- ⑥ METERED H2O2 THRU P-71 TO BOTTOM OF THE H2 RECOVERY COLUMN, THE H2S EXTRACTOR.
- ⑦ ORGANIC PHASE FROM TOP OF H2 STRIPPER TO BOTTOM OF H2S EXTRACTOR.
- ⑧ AQUEOUS PHASE FROM BOTTOM OF THE H2 STRIPPER (THRU GRAVITY LEG) PUMPS (P-61) TO LINE 50-6 TO THE TOP OF THE H2S EXTRACTOR.
- ⑨ ORGANIC PHASE FROM AIR SEPARATOR LEGS OF H2S EXTRACTOR (THRU PUMPS (P-62)) TO THE BOTTOM OF H2S EXTRACTOR.
- ⑩ AQUEOUS PHASE FROM TOP OF H2 STRIPPER (THRU GRAVITY LEG) PUMPS (P-63) TO TOP OF H2S EXTRACTOR.
- ⑪ ORGANIC PHASE FROM BOTTOM OF H2S EXTRACTOR (THRU GRAVITY LEG) TO TOP OF THE CNS RECOVERY COLUMN.
- ⑫ ORGANIC PHASE FROM AIR SEPARATOR LEGS OF H2S EXTRACTOR (THRU PUMPS (P-64)) TO BOTTOM OF H2S EXTRACTOR.
- ⑬ ORGANIC PHASE FROM TOP OF H2 STRIPPER (THRU GRAVITY LEG) PUMPS (P-65) TO BOTTOM OF THE SULPHURIC ACID STRIPPER.
- ⑭ AQUEOUS PHASE FROM BOTTOM OF H2 STRIPPER (THRU GRAVITY LEG) TO TOP OF THE H2S STRIPPER.
- ⑮ ORGANIC PHASE FROM AIR SEPARATOR LEGS OF H2S STRIPPER (THRU PUMPS (P-66)) TO BOTTOM OF H2S STRIPPER.
- ⑯ OVERFLOW FROM ALL EXTRACTION DOCKING AND GRAVITY LEGS TO THE OVERFLOW DRAIN ON THE FLOOR.
- ⑰ ZACL FROM BOTTOM OF THE CNS RECOVERY COLUMN (THRU PUMPS (P-67)) TO THE POLYMERIZATION AREA ON THE 410 FLOOR.
- ⑱ HAZIUM FROM BOTTOM OF THE SULPHURIC ACID STRIPPER (THRU GRAVITY LEG) TO PEND MAKE UP AREA IN THE TANK PIT.

GENERAL NOTES

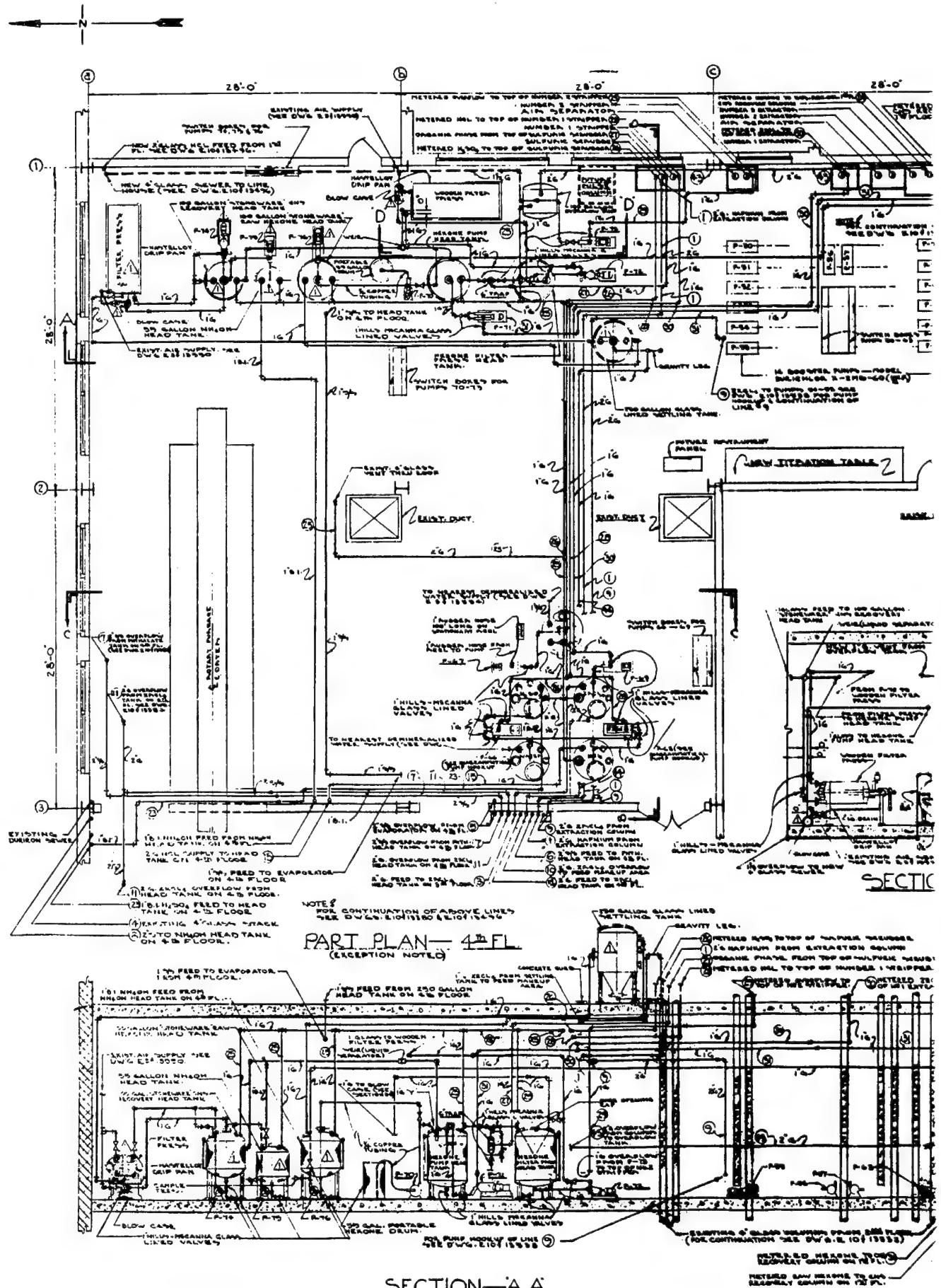
- 1—ALL PIPING SHOWN DIAGRAMMATICALLY ONLY.
- 2—ALL PIPING TO BE PYREX GLASS SIZE AS SHOWN.
- 3—LINE VALVES TO BE HILLY-MARCARA GLASS LINED VALVES.
- 4—ALL HILLY-MARCARA GLASS LINED VALVES ON THE 1ST FLOOR TO BE NICKEL-PLATED.
- 5—USE 0-25 GAGE ETY OR ALL GLASS LINES.
- 6—LINE SET TO WELDING ROOM WHEN WELDING OF COLUMN SUPPORTS.
- 7—ELEVATION OF OVERFLOW LINE ON 910 FLOOR (SEE DWG E-107-13458).
- 8—WATER 50-63 TO BE DULICHLOR A-2100 CO (100% BOOSTER PUMPS) FOR LOCATION OF PUMPS SEE DWG E-107-13458.
- 9—FOR CONTINUATION OF LINES (1), (5), (26), (27), (28), (29), (30) & (31) SEE DWG E-107-13458, E-107-13459, E-107-13460.
- 10—ALL COLUMNS TO BE 4" PYREX GLASS PIPE BESIDE ONE (1) 10' SECTION OF 6" GLASS PIPE & EACH SPECIAL REDUCING BELL AT THE TOPS OF ALL COLUMNS.

REF. DWG 67.

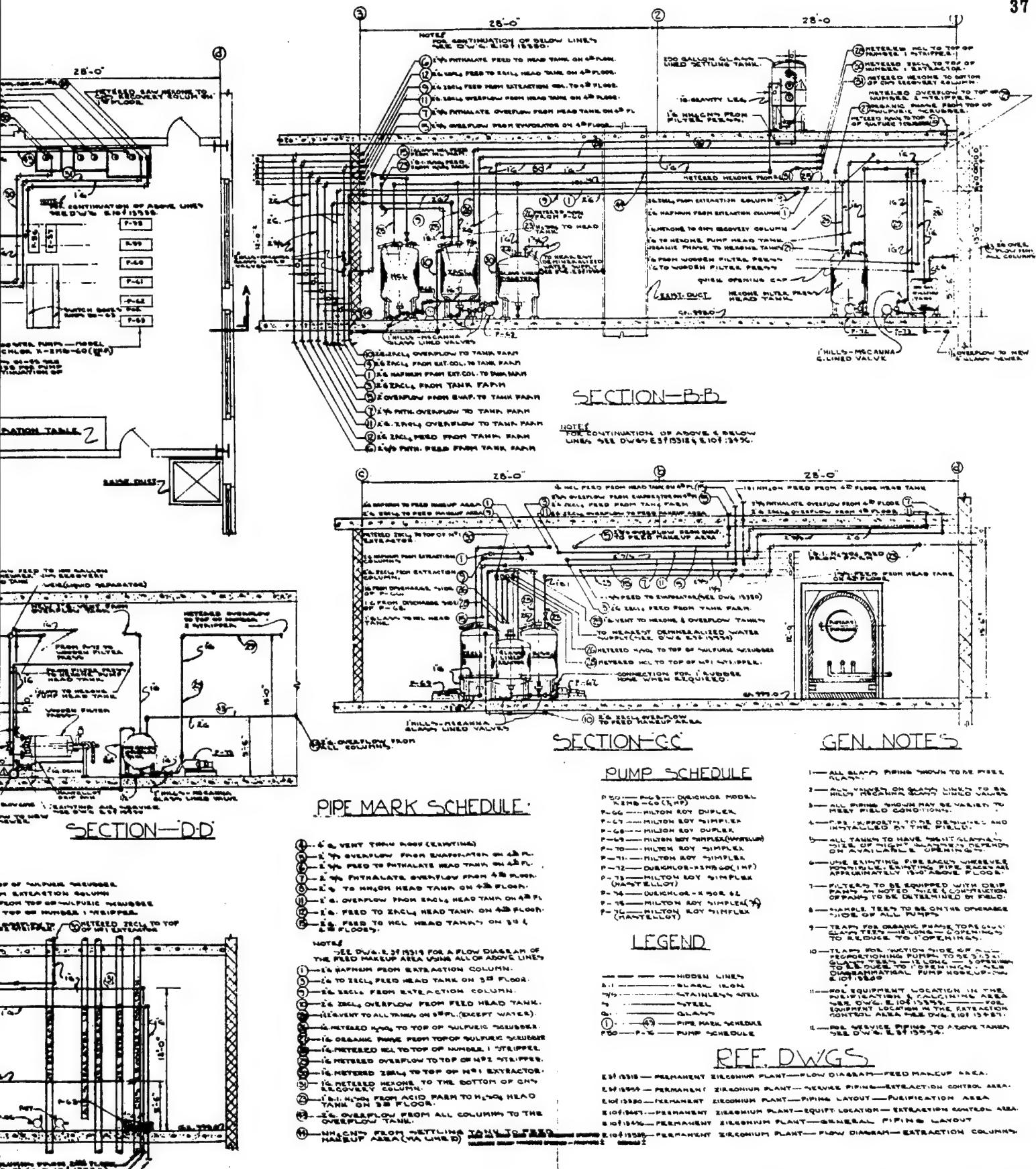
E-107-13456 — PERMANENT ZIRCONIUM PLANT — FLOW DIAGRAM — FEED MAKEUP AREA.
 E-107-13457 — PERMANENT ZIRCONIUM PLANT — PIPING LAYOUT — PURIFICATION AREA.
 E-107-13458 — PERMANENT ZIRCONIUM PLANT — PIPING LAYOUT — EXTRACTION CONTROL AREA.
 E-107-13459 — PERMANENT ZIRCONIUM PLANT — GENERAL PIPING LAYOUT.

LEGEND

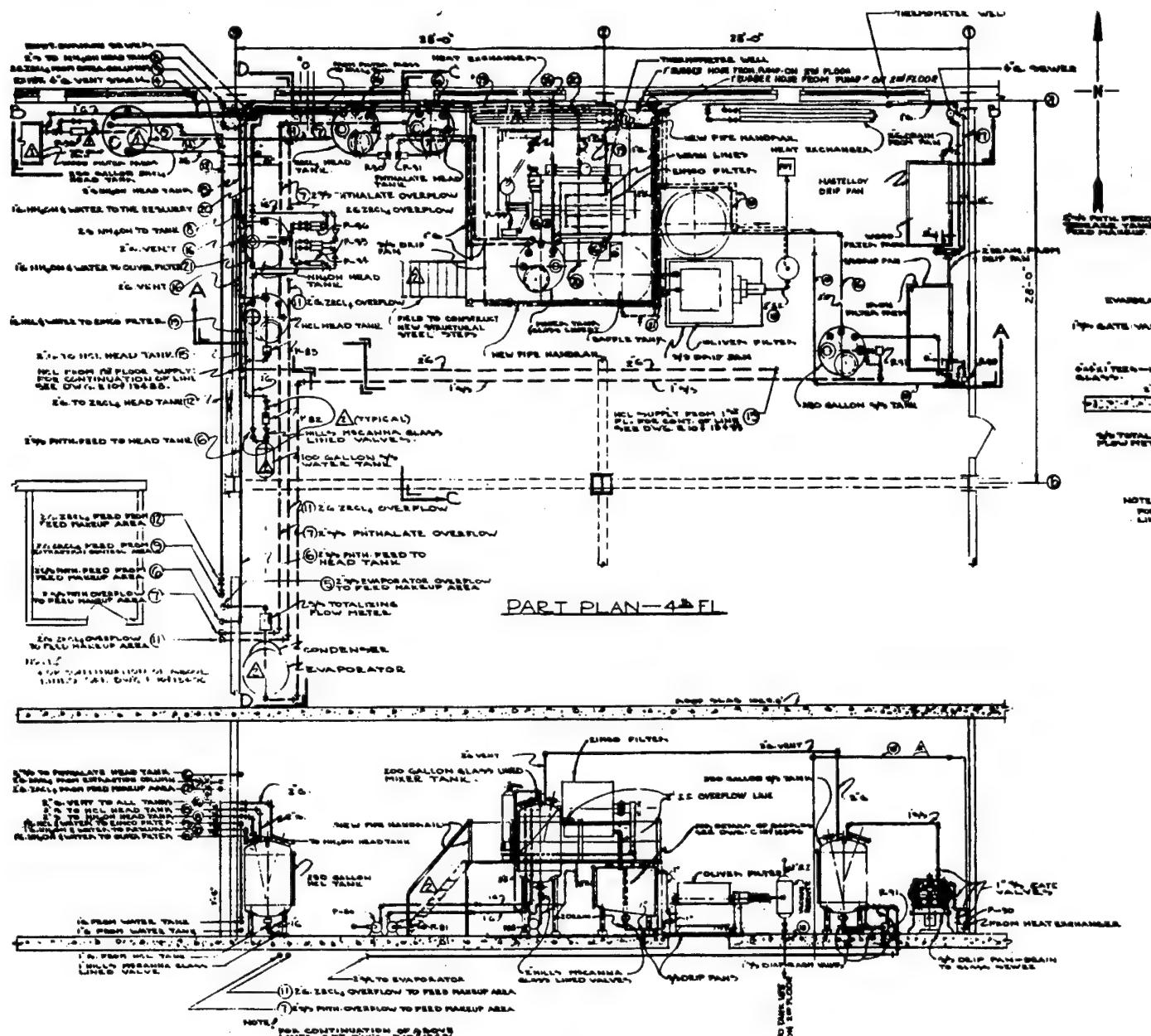
(1), (3) & (2) PIPE MARK SCHEDULE
 DULICHLOR XERO-50(100%) BOOSTER PUMPS
 RUBBER GRAVITY LEGS



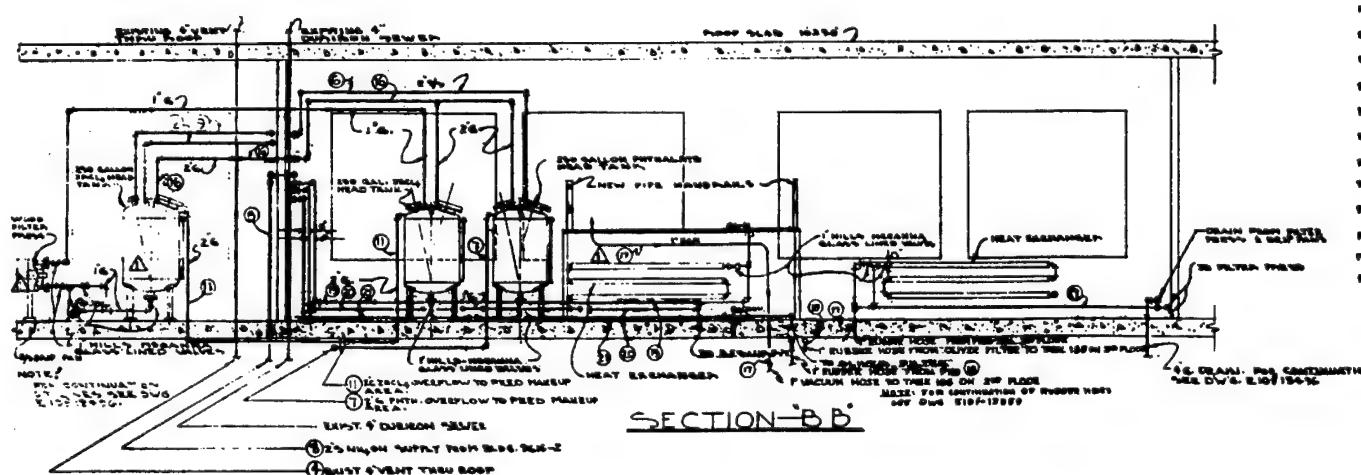
SECTION—AA

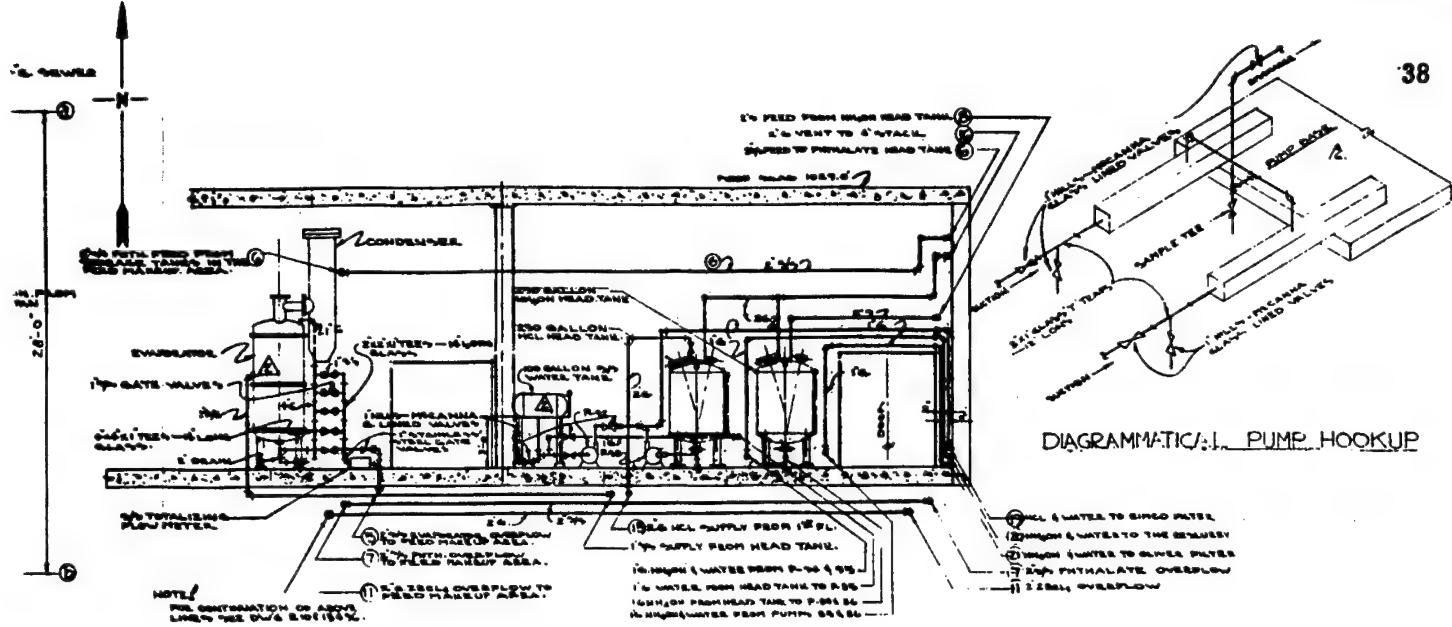


PERMANENT ZIRCONIUM PLANT PIPING LAYOUT-EXTRACTION CONTROL AREA, PLANS & SECTIONS



SECTION—AA'

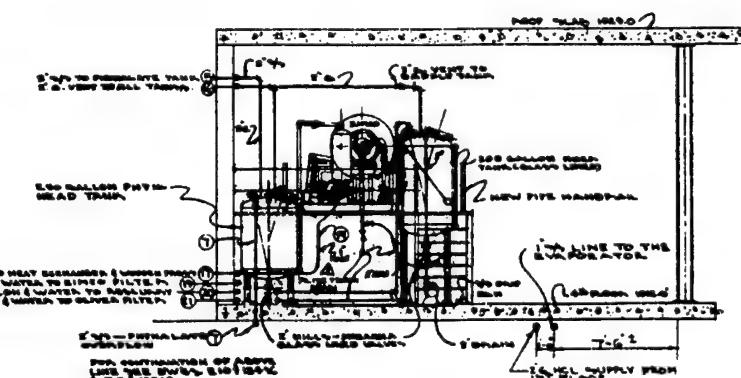




DIAGRAMMATICAL PUMP HOOKUP

SECTION—DD

LEGEND



5/8" -- STAINLESS STEEL
 3" -- STEEL
 6" -- PYREX GLASS PIPE
 8" -- BLACK IRON
 FLEXIBLE RUBBER HOSE
 PUMP NUMBERING (SEE PUMP SCHEDULE)
 (4) (2) PIPE NUMBERING (SEE PIPE MARK SCHEDULE)
 HIDDEN LINER UNDER FLOOR OR
 PLASTER

REF. DWG'S.

E 10⁴15295—PERMANENT ZIRCONIUM PLANT—EQUIPMENT LOCATION—PURIFICATION & CALCINING AREAS.

E 10⁴15296—PERMANENT ZIRCONIUM PLANT—GENERAL PIPING LAYOUT

E 10⁴15298—PERMANENT ZIRCONIUM PLANT—PIPING

SECTION-C C

PUMP SCHEDULE

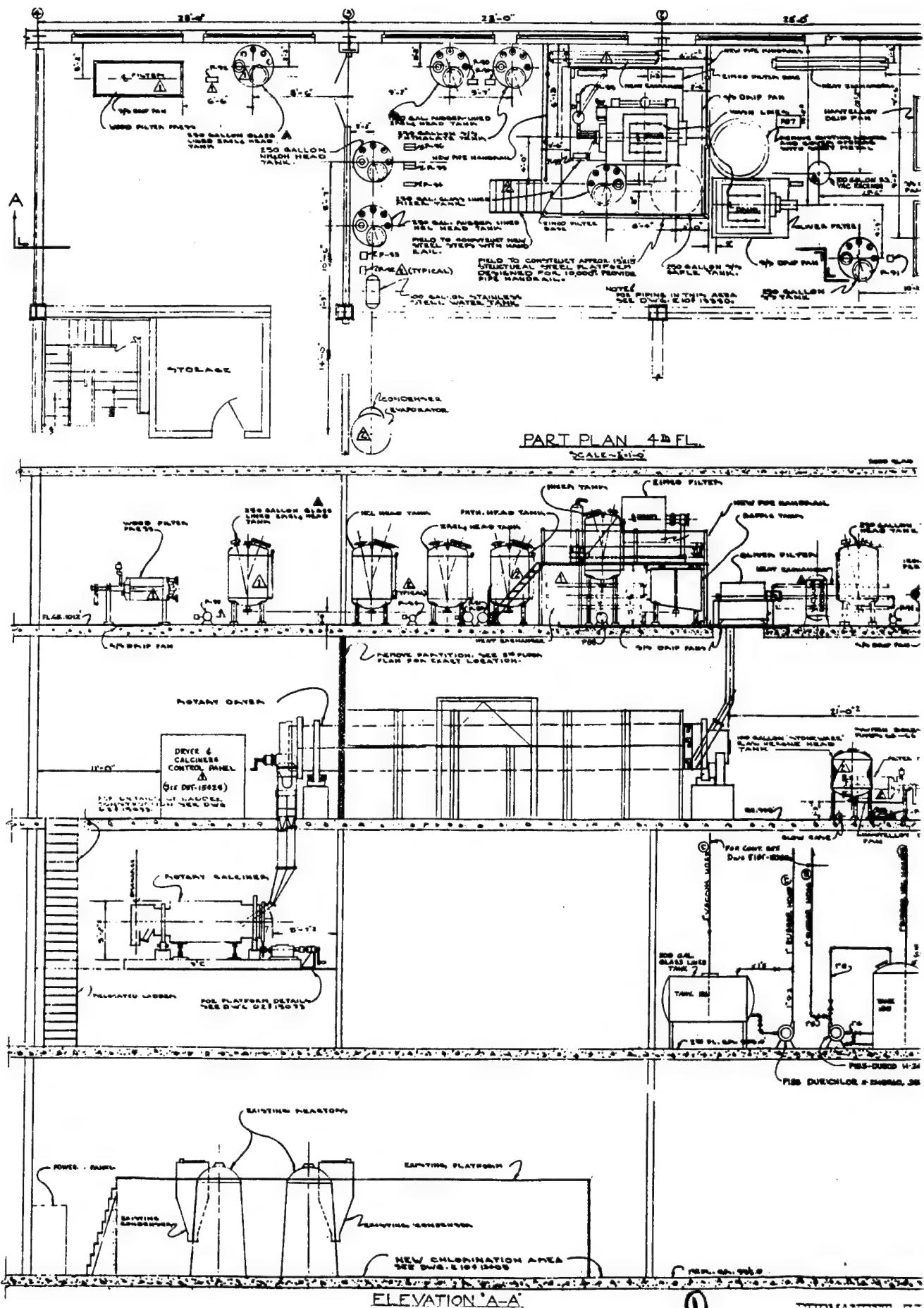
P-60	FILTER SET TRIFLEX	STAINLESS STEEL
P-61	FILTER SET TRIFLEX	STAINLESS STEEL
P-62	FILTER SET TRIFLEX	STAINLESS STEEL
P-63	FILTER SET TRIFLEX	STAINLESS STEEL
P-64	FILTER SET TRIFLEX	STAINLESS STEEL
P-65	FILTER SET DUPLEX	STAINLESS STEEL
P-66	FILTER SET DUPLEX	STAINLESS STEEL
P-67	MILSO REGULATING DUPLEX	STAINLESS STEEL
P-68	VACUUM PUMP(H-4)	NASH HYTOR
P-69	HEATER PUMP	SS304 OR SS316L
P-70	VACUUM PUMP	NASH HYTOR
P-71	SWING PUMP	STAINLESS STEEL
P-72	SWING PUMP	STAINLESS STEEL
P-73	SWING PUMP	STAINLESS STEEL (W/ H-4)

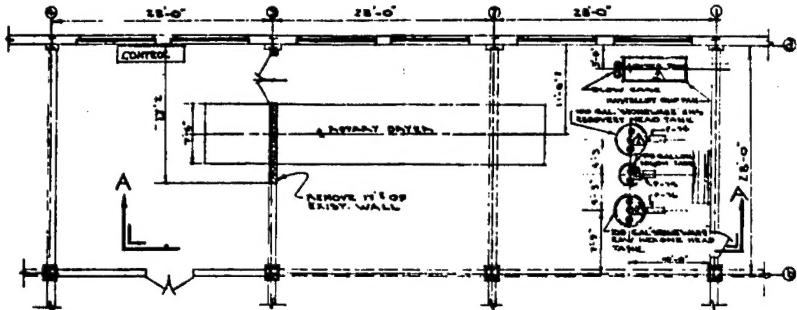
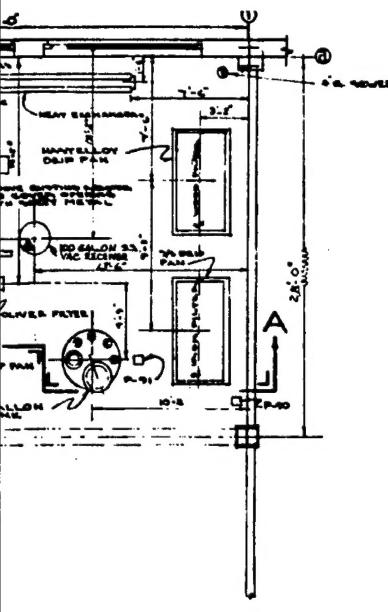
PIPE MARKS SCHEDULE

⑨ 5-GAL. FROM EXTRACTION COLUMN
⑩ SEVANT PUMP 145PL. TO BURNING 4' BACK.
⑪ 2-1/2 GALLON EVAPORATOR ON 4th FLOOR.
⑫ 2-1/2 PL. PUMP TO PHthalate HEAD TANK ON 4th FLOOR.
⑬ 2-1/2 PL. PHthalate OVERFLOW PUMP ON 4th FLOOR.
⑭ 2-1/2 PL. PUMP TO NH4OH HEAD TANK ON 4th FLOOR.
⑮ 2-1/2 PL. OVERFLOW FROM INCL. HEAD TANK ON 4th FL.
⑯ 2-1/2 PL. PUMP TO ENCL. HEAD TANK ON 4th FLOOR.
NOTE:
SEE FIG. E 2133B FOR A FLOW DIAGRAM OF THE
FIELD NUMBER AREA USING ALL OF THE ABOVE LINES.
⑰ 2-1/2 PL. PUMP TO HCl HEAD TANK ON 4th FLOOR.
⑱ 2-1/2 PL. VENT TO ALL TANKS (EXCEPT WATER).
⑲ 1-1/2 PL. PUMP TO HEAT EXCHANGER & WORM PRESS.
⑳ 1-1/2 PL. FROM OLIVER FILTER TO IRON FILTER UNITS.
㉑ 1-1/2 PL. HCl & WATER TO IRIMCO FILTER.
㉒ 1-1/2 PL. NH4OH & WATER TO THE IRIMCO UNIT.
㉓ 1-1/2 PL. NH4OH & WATER TO THE OLIVER FILTER.

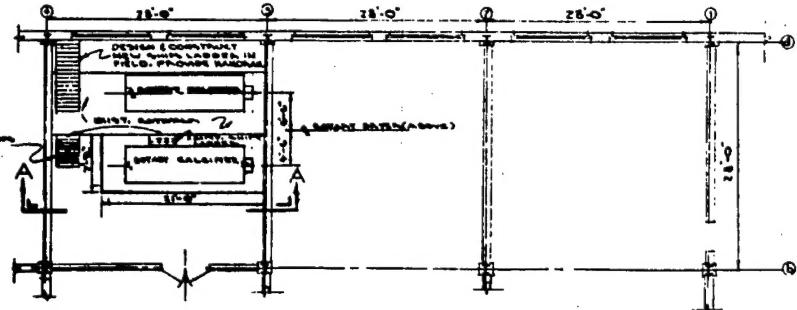
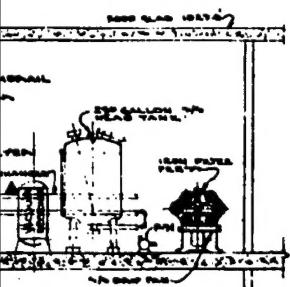
GEN. NOTES

- 1. ALL GLASS TUBING SHOWN TO BE PYREX GLASS.
- 2. ALL VALVES ON GLASS LINED TO BE MILITARY CANNA GLASS TUBING, EXCEPT WHERE NOTED.
- 3. USE MILITARY CANNA OR DIAPHRAGM VALVES ON GLASS LINED & BRASS OR STEEL VALVES ON STEEL OR BLACK IRON LINED.
- 4. PIPING SHOWN DIAPHRAGMATICALLY ONLY AND MAY BE VARIED TO MEET FIELD CONDITIONS.
- 5. PIPE SUPPORTS TO BE DESIGNED AND INSTALLED BY THE FIELD.
- 6. GLASS PIPE MAY BE SUBSTITUTED FOR BRASS OR STEEL PIPES WHEREVER IT IS MORE EXPENSIVE.
- 7. PIPING WORKS FOR WOOD FRAMED BUILDINGS TO THE SAME AS CEMENT SIDE REINFORCED CONCRETE.
- 8. ALL FILTER PRESSES TO BE EQUIPPED WITH DIP PANS, AS NOTED. DIP PANS TO BE SIZED & CONSTRUCTED IN THE FIELD.
- 9. FOR EQUIPMENT LOCATION IN THE PURIFICATION & CALCINING AREAS SEE DWG E 10419397.
- 10. DIAPHRAGMATIC PUMP HOSE UP TO APPLY TO ALL MOLTEN BATH DUPLEX PUMPS.

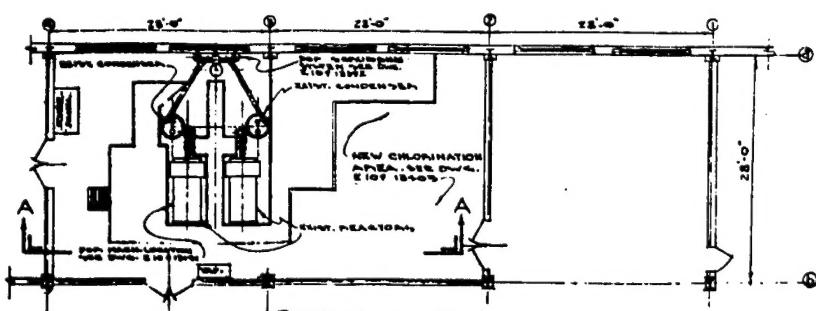
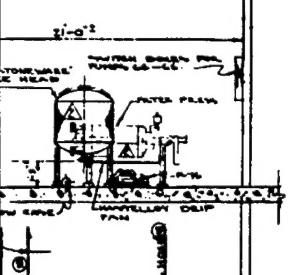


PART PLAN - 3RD FL

SCALE ~ 1/8=1'-0"

PART PLAN - 2ND FL

SCALE ~ 1/8=1'-0"

PART PLAN - 1ST FL

SCALE ~ 1/8=1'-0"

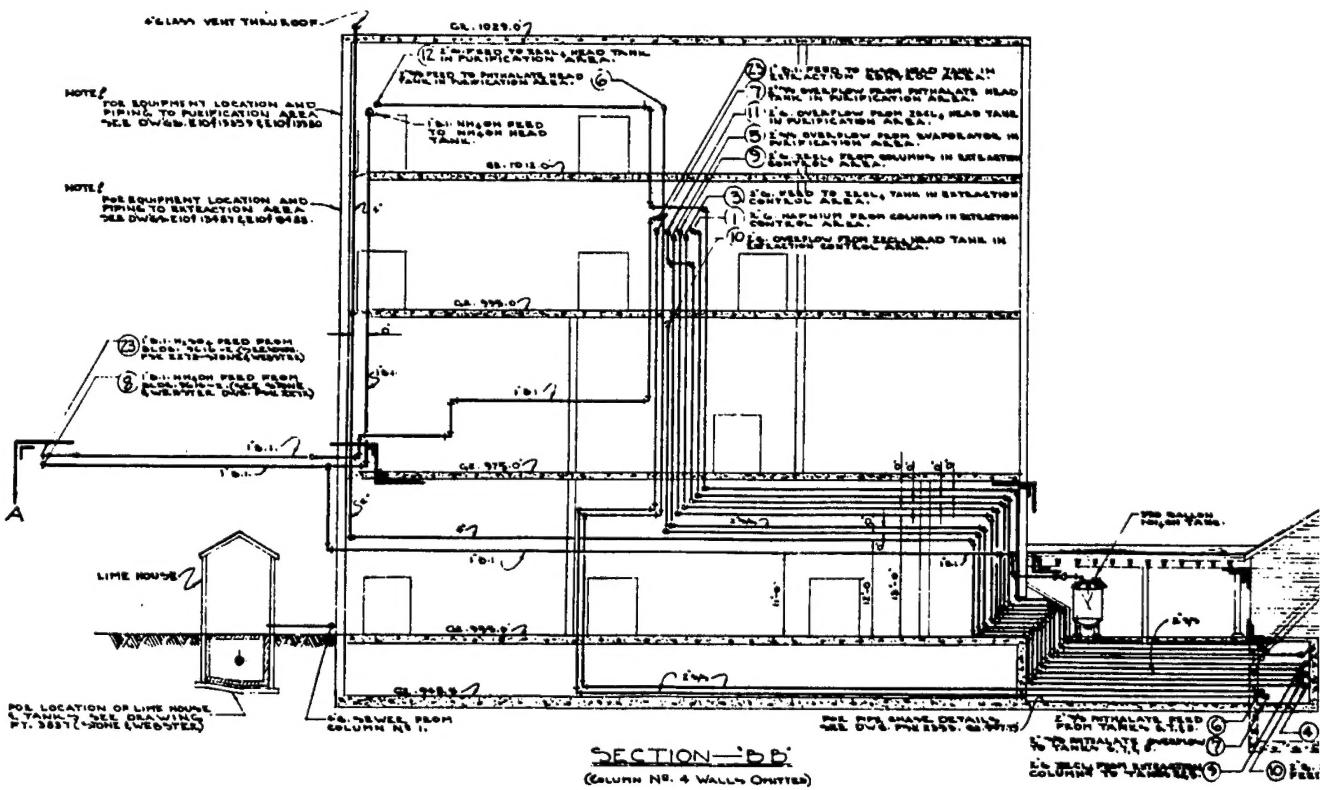
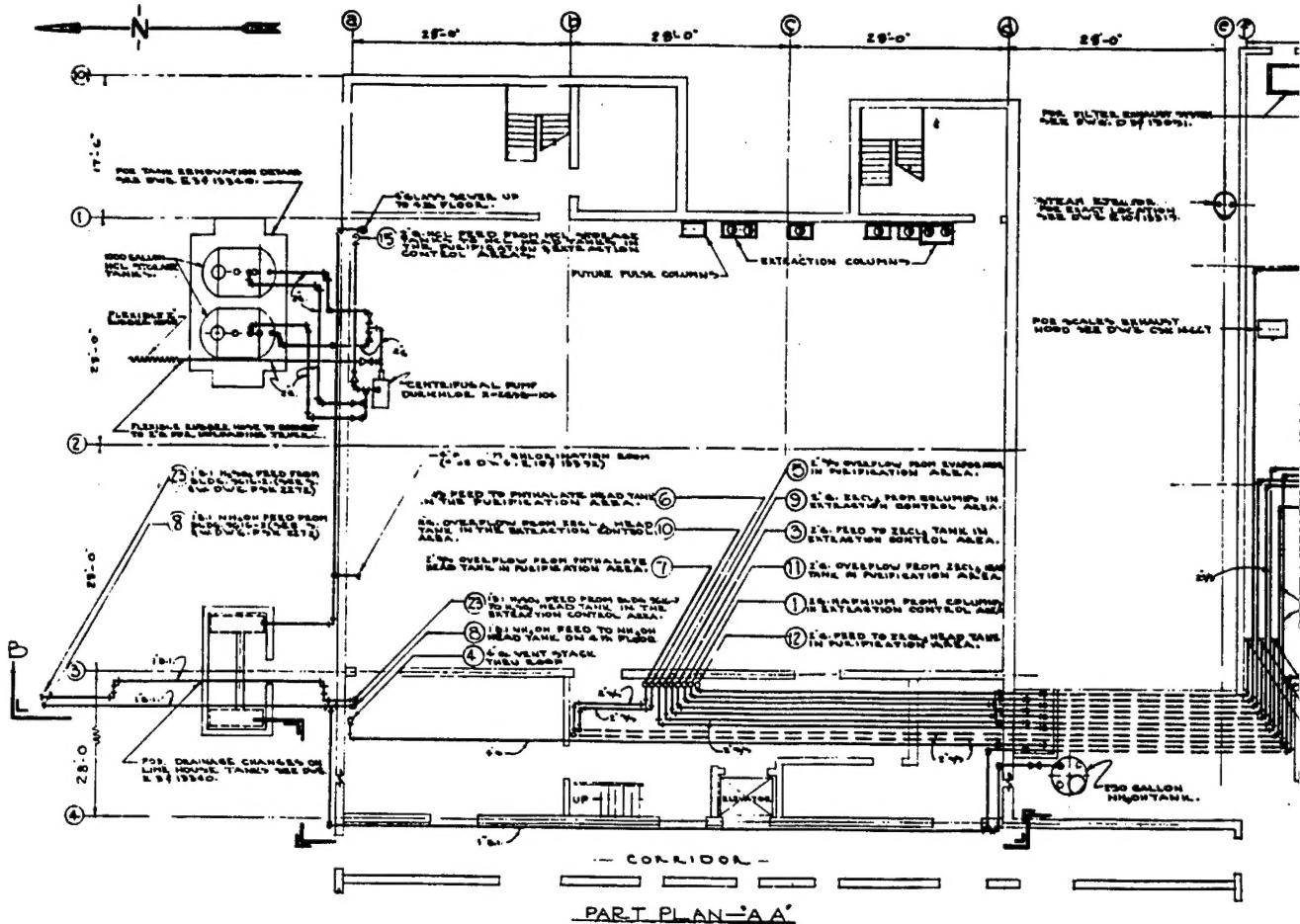
R.F.D.W.G.S.

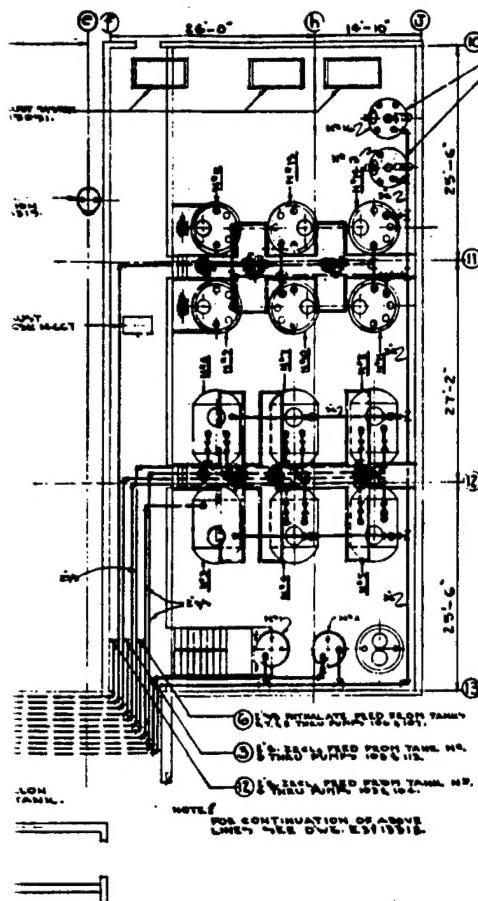
E-01-1950 PERMANENT ZECONIUM PLANT — EQUIPMENT
B-01-1950 PERMANENT ZECONIUM PLANT — EQUIPMENT
EXTRACTION CONTROL AREA.
E-01-1950 PERMANENT ZECONIUM PLANT — STRUCTURAL
ALTERATION — EXTRATION CONTROL AREA.
E-01-1950 PERMANENT ZECONIUM PLANT — PIPING
LAYOUT — POLYMERIZATION AREA.
E-01-1951 PERMANENT ZECONIUM PLANT — EQUIPMENT
LOCATION — CHLORINATION SYSTEM.
E-01-1952 PERMANENT ZECONIUM PLANT — POLYMER
SYSTEM — ZECONIUM CHLORINATION.
E-01-1950 PERMANENT ZECONIUM PLANT — EQUIPMENT
LOCATION — REACTOR AREA.
H-004-1951 INSTANT DRYER — C.O. BARTLETT & SNOV CO.
B-004-1951 INSTANT DRYER — C.O. BARTLETT & SNOV CO.
B-004-1951 100 GALLON 250 GPM FILTER — EIMCO CORPORATION
B-004-1951 100 GALLON 250 GPM FILTER — OLIVER UNITED FILTER
INC 19409 INSTANT FILTER PRESS — B.R. SPEAR AND CO.
B-004-1951 CONTROL PANEL
NOTE: ALL FILTERS AND FILTER PRESSES SHOWN
SHOULD BE LOCATED ON THE FIELD.

GEN. NOTES

- 1— ALL EQUIPMENT AND CONSTRUCTION SHOWN ON E-01-1950 IS TO BE NEW, EXCEPTION NOTED.
- 2— ALL EQUIPMENT SHOWN ON E-01-1950 IS EXISTING.
- 3— ALL TANK SUPPORTS TO BE DESIGNED IN THE FIELD.
- 4— DIMENSIONS SHOWN ARE APPROXIMATE AND MAY BE VARIED TO MEET FIELD CONDITIONS.
- 5— SEE MANUFACTURER'S DRAWINGS FOR DETAILS OF INSTANT DRYER, INSTANT CALIBRER, EIMCO OLIVER FILTERS, FILTER PRESSES.
- 6— PIPING LOCATED BY E-01-1950 IS TO BE LOCATED APPROX. 10 FEET FROM BUTT-JEAD LOCATION TO BE DETERMINED IN FIELD.
- 7— FOR PUMP SCHEDULE SEE DWG. NO. E-01-1950.
- 8— ALL FILTER PRESSES TO BE EQUIPPED WITH DRAIN VALVES AND DRAIN DRAWS TO BE DETERMINED IN THE FIELD.
- 9— ALL TANKS TO BE EQUIPPED WITH DRAIN VALVES AND DRAIN DRAWS TO BE DETERMINED IN THE FIELD.

(2)





GENERAL NOTES

- FOR SERVICE PIPING TO THE FEED MAKEUP AREA, EXTRACTION CONTROL AREA, AND FILTERS, USE 304 STAINLESS STEEL WINGS.
- FOR EQUIPMENT LOCATION TO THE FEED MAKEUP AREA, EXTRACTION CONTROL AREA, AND FILTERS, SEE DWG. E 10415319, E 10415320, E 10415321.
- FOR EXHAUST VENTER IN THE EXTRACTION CONTROL AREA & PURIFICATION AREA, SEE DWG. E 10415320 & E 10415321.
- FOR AREA 2000 EXHAUST SYSTEM IN THE FEED MAKEUP AREA, SEE DWG. E 10415321.
- FOR FILTERS, PHASE EXHAUST SYSTEM IN THE FEED MAKEUP AREA, EXTRACTION CONTROL AREA & PURIFICATION AREA, SEE DRAWINGS DWG. E 10415320 & E 10415321.
- ALL PIPING SHOWN DIMENSIONAL CENTER LINE LOCATION TO BE DETERMINED BY FIELD.
- ALL PIPING SHOWN TO BE GLASS EXCEPT WHERE NOTED.
- PIPE SUPPORTS TO BE DESIGNED AND INSTALLED BY THE FIELD.
- FOR CONDUIT PLAN OF THE EXTRACTION CONTROL AREA SEE DWG. E 10415320.

PIPE MARK SCHEDULE

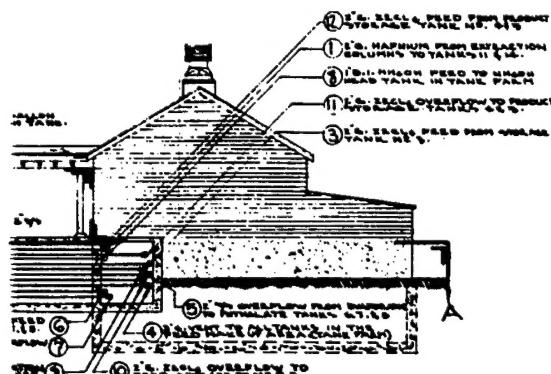
- E.G. HAPNIUM FLOW COLUMN IN EXTRACTION CONTROL AREA TO HAPNIUM TANK 4211 IN FEED MAKEUP AREA.
- E.G. EXHAUST FROM PHALATE TANK 4211 IN FEED MAKEUP AREA TO STEEL HEAD TANK IN EXTRACTION CONTROL AREA.
- E.G. VENT FROM ALL TANKS IN THE FEED MAKEUP AREA TO THE NORTH WALL OF BLDG. 4211 & THEN THRU A VENT WITH A 45° TURN.
- E.G. OVERFLOW FROM EXHAUST IN PURIFICATION AREA TO PHALATE HEAD TANK 4211 IN THE FEED MAKEUP AREA.
- E.G. EXHAUST FROM PHALATE HEAD TANK 4211 IN FEED MAKEUP AREA TO PHALATE HEAD TANK IN PURIFICATION AREA.
- E.G. OVERFLOW FROM PHALATE HEAD TANK 4211 IN PURIFICATION AREA TO PHALATE HEAD TANK 4211 IN THE FEED MAKEUP AREA.
- E.G. HAPNIUM FLOW FROM BLDG. 4211 TO HAPNIUM HEAD TANK IN THE FEED MAKEUP AREA (SEE DWG. E 10415320).
- E.G. ZEOLITE FLOW COLUMN IN EXTRACTION CONTROL AREA TO PRODUCT STORAGE TANKS 4211 IN FEED MAKEUP AREA.
- E.G. OVERFLOW FROM STEEL HEAD TANK IN EXTRACTION CONTROL AREA TO PRODUCT STORAGE TANK 4211 IN FEED MAKEUP AREA.
- E.G. OVERFLOW FROM ZEOLITE HEAD TANK IN PURIFICATION AREA TO PRODUCT STORAGE TANK 4211 IN FEED MAKEUP AREA.
- E.G. ZEOLITE FLOW FROM PRODUCT STORAGE TANKS IN FEED MAKEUP AREA TO ZEOLITE HEAD TANK IN PURIFICATION AREA.
- E.G. HCL FEED FROM BLDG. 4211 TO HCL HEAD TANKS IN THE PURIFICATION & EXTRACTION CONTROL AREA.
- E.G. VENT TO ALL TANKS (EXCEPT WATER) IN THE PURIFICATION AREA.
- E.G. HCL FEED FROM BLDG. 4211 TO HCL HEAD TANKS IN THE PURIFICATION & EXTRACTION CONTROL AREA (SEE DWG. E 10415320).
- E.G. VENT TO ALL TANKS (EXCEPT WATER) IN THE EXTRACTION CONTROL AREA.

R.F. DWGS.

PFT 10415320—TANK FARM, STOCKPILE PLATFROM—STONE & WEEDER
PFT 10415321—VAPOR PIPING—BLDG. 4211—STONE AND WEEDER
PT 10415322—PERMANENT ZIRCONIUM PLANT—PUMP HOUSE AND SAMPLING TANKS
E 10415323—PERMANENT ZIRCONIUM PLANT—CONDUIT PLATE—EXTRACTION CONTROL AREA
DWG. 4211—PERMANENT ZIRCONIUM PLANT—FILTER, FILTER EXHAUST SYSTEM—PURIFICATION AREA
DWG. 4211—PERMANENT ZIRCONIUM PLANT—HAPNIUM HOOD—FEED MAKEUP AREA
E 10415324—PERMANENT ZIRCONIUM PLANT—EXHAUST HOOD—FEED MAKEUP AREA
DWG. 4211—PERMANENT ZIRCONIUM PLANT—FEED EXHAUST SYSTEM—FEED MAKEUP AREA
DWG. 4211—PERMANENT ZIRCONIUM PLANT—FEED EXHAUST SYSTEM—EXTRACTION CONTROL AREA
DWG. 4211—PERMANENT ZIRCONIUM PLANT—FILTER, FILTER EXHAUST SYSTEM—PURIFICATION AREA
E 10415325—PERMANENT ZIRCONIUM PLANT—EQUIPMENT LOCATION—FEED MAKEUP AREA
E 10415326—PERMANENT ZIRCONIUM PLANT—EQUIPMENT LOCATION—PURIFICATION & CALCINING AREA
E 10415327—PERMANENT ZIRCONIUM PLANT—PIPING LAYOUT—PURIFICATION AREA
E 10415328—PERMANENT ZIRCONIUM PLANT—PIPING LAYOUT—EXTRACTION CONTROL AREA
E 10415329—PERMANENT ZIRCONIUM PLANT—PIPING LAYOUT—EXTRACTION CONTROL AREA
E 10415330—PERMANENT ZIRCONIUM PLANT—SERVICE LINES—EXTRACTION CONTROL AREA
E 10415331—PERMANENT ZIRCONIUM PLANT—SERVICE LINES—PURIFICATION AREA
E 10415332—PERMANENT ZIRCONIUM PLANT—DEMINERALIZED WATER—FEED MAKEUP AREA
E 10415333—PERMANENT ZIRCONIUM PLANT—CONTACT TANK, RENOVATION—BLDG. 4211-C
E 10415334—PERMANENT ZIRCONIUM PLANT—CHLORINATION SCRUBBING SYSTEM
DWG. 4211—PERMANENT ZIRCONIUM PLANT—ONE LINE DIABEATH—EXTRACTION CONTROL AREA

TANK SCHEDULE

1. E.745 — PHALATE STORAGE
2. — — HAPNIUM
3. — — FEED STORAGE
4. 5 — — PRODUCT STORAGE
5. 10.15.15 — FEED MAKEUP
11. 15.15.16 — HAPNIUM



LEGEND

- (1) (2) PIPE NUMBERING (NEAR PIPE RAIL THERMO)
- HIDDEN LINES
- B.I. BLACK IRON
- S.S. STAINLESS STEEL
- S. STEEL
- F.R.B. FLEXIBLE RUBBER HOSE
- G. GLASS
- (3) EXTRACTION COLUMN

NOTE: AS SHOWN THIS DRAWING SHOWS EXISTING
EXISTING TANKS LOCATED ON PROPERTY

PERMANENT ZIRCONIUM PLANT, GENERAL PIPING LAYOUT

(2)

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